HP Enterprise Modular Library E-Series
User Guide

HP Part Number: AH876-96010
Published: December 2012
Edition: 8th

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1 Library overview

The HP Enterprise Modular Library (EML) E-Series Tape Libraries provide performance, reliability and investment protection for your data protection needs. With up to 16 HP LTO tape drives, the EML E-Series boasts native throughput of over 6.9 TB/hr. Based on the HP Extended Tape Library Architecture (ETLA), controllers help to ensure that rogue I/O requests do not interrupt the backup or recovery job in progress. Additionally, the hardware itself is very reliable, designed for 24x7 environments. Investment protection is achieved through the addition of expansion modules, the EML E-Series library scales within the library footprint to 16 drives and 442 slots for maximum performance, or 8 drives and 505 slots for maximum capacity.

The EML E-Series Tape Libraries contain the following features:

- Scalable capacity from 71 slots to 505 slots
- Scalable performance up to 16 Ultrium tape drives with 442 slots
- Interface controllers protect tape drives from SAN events
- Remote management via Command View for Tape Libraries software or the command line interface
- Easy to use touch screen graphical user interface
- User configurable load ports with removable magazines
- Certified under the HP Enterprise Backup Solution (EBS)
- Factory and field rack configurations
- 2,000,000 mean swaps between failure

Available configurations

You can order the library in the following configurations.

Table 1 EML configurations

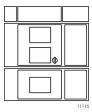
Configuration	Illustration	Height in "U"	Maximum slots available	Configurable load port slots (in multiples of 5)	Configurable reserved slots	Number of possible tape drives
71e1 base modulefield racked		12	71	0–5	0	1–4
103e1 base modulefactory racked		12	103	0–5	0–9	1–4

Table 1 EML configurations *(continued)*

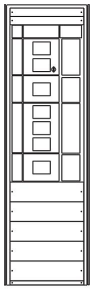
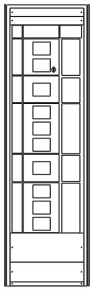
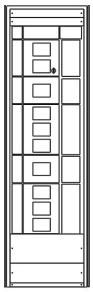
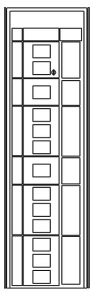
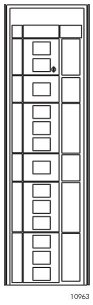
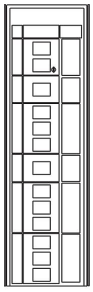
Configuration	Illustration	Height in "U"	Maximum slots available	Configurable load port slots (in multiples of 5)	Configurable reserved slots	Number of possible tape drives
245e1 base module1 tape drive expansion module1 card cage expansion modulefactory racked		24	245	0–15	0–9	1–8
348e1 base module2 tape drive expansion modules1 card cage expansion modulefactory racked		32	348	0–25	0–9	1–12
375e1 base module1 tape drive expansion module1 card cage expansion module1 capacity expansion modulefactory racked		32	375	0–25	0–9	1–8
442e1 base module3 tape drive expansion modules1 card cage expansion modulefactory racked		40	442	0–35	0–9	1–16

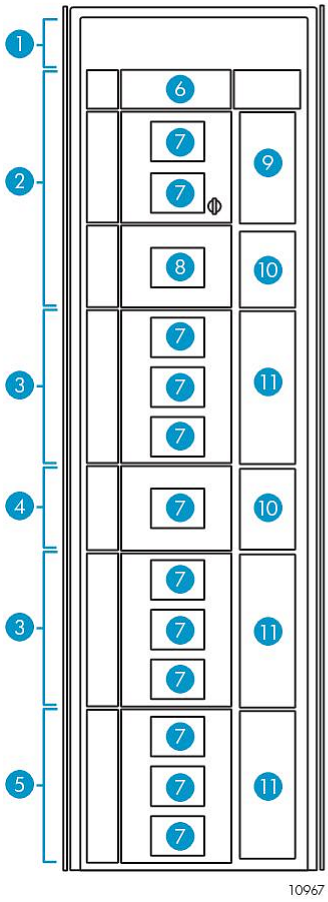
Table 1 EML configurations *(continued)*

Configuration	Illustration	Height in "U"	Maximum slots available	Configurable load port slots (in multiples of 5)	Configurable reserved slots	Number of possible tape drives
469e1 base module2 tape drive expansion modules1 card cage expansion module1 capacity expansion modulefactory racked		40	469	0–35	0–9	1–12
505e1 base module1 tape drive expansion module1 card cage expansion module2 capacity expansion modulesfactory racked		40	505	0–35	0–9	1–8

Parts of the library

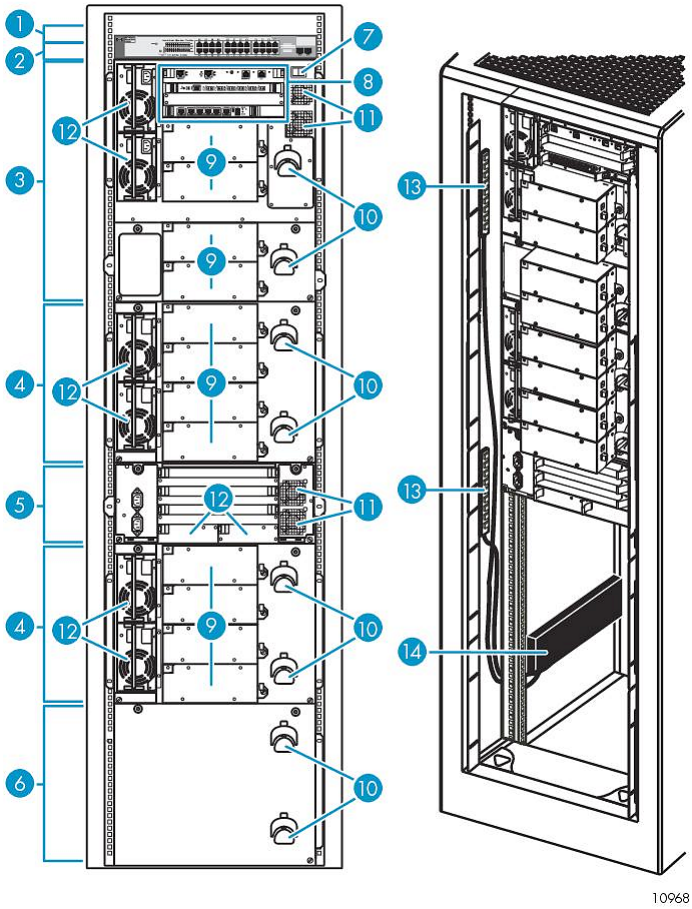
The following figures show the parts of a 469e library. See (page 7).

Figure 1 Front view of the library



1. Reserved space. If your library contains LTO4 or later tape drives, this space contains the switch for the internal network.
2. Base module
3. Tape drive expansion module
4. Card cage expansion module
5. Capacity expansion module
6. Robotics unit
7. Viewing windows
8. Operator control panel (OCP)
9. 5-Cartridge load port
10. 4U blank covers
11. 10-Cartridge load ports

Figure 2 Rear view of the library



1. Reserved space
2. Switch for the internal network (in libraries with LTO4 or later tape drives only)
3. Base module
4. Tape drive expansion module
5. Card cage expansion module
6. Capacity expansion module
7. Main power switch
8. Base module card cage (e2400-FC 2Gb interface controller shown)
9. Tape drives (LTO3 tape drives shown)
10. Cable management features
11. Fans
12. Power supplies
13. Power strips
14. Power distribution unit (PDU)

Base module

The 12U base module (see (page 10) and (page 11)) resides at the top of the library below the 2U reserved space or the switch for the internal network.

In the EML 71e, the base module contains a total of 71 LTO slots. Five slots within a load port are configurable as either import/export slots or storage slots. No reserved slots are available.

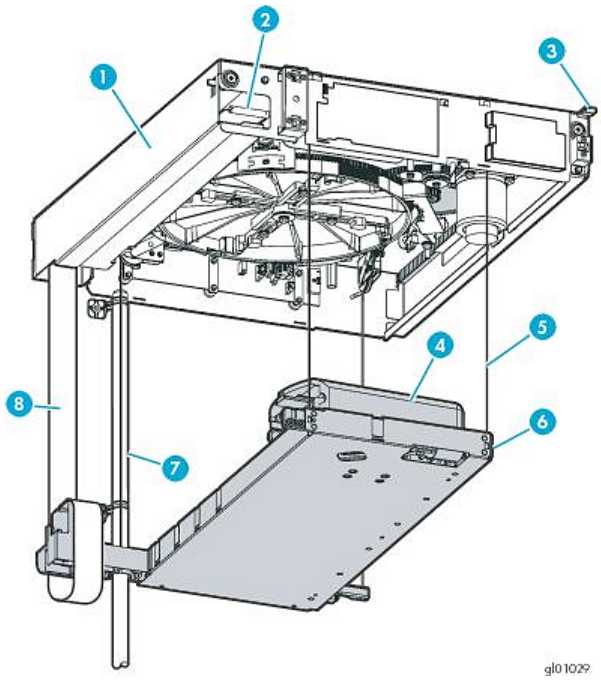
In all other EML configurations, the base module contains a total of 103 LTO slots. Five slots are configurable as either import/export slots or storage slots within a load port through the use of a removable magazine. You can configure 9 slots as reserved. A common use for reserved slots is for holding cleaning cartridges. The number of usable permanent slots depends on whether it is the bottom module in the library because the library floor is always attached to the bottom module

and the floor limits the distance that the robot can travel. If the library floor is attached to the base module, the bottom two rows (containing 16 slots) cannot be used.

The robotics unit is located at the top of the base module. When fully retracted (or *parked*), the robot is fully contained within a 2U space. For safety reasons, the robot is parked before the center door can be opened.

Within the robot, a lift table assembly contains a motor, pulleys, and cables to move the table up and down to a specific level in the library. The picker assembly moves front and back, and side-to-side along the table. A barcode scanner, attached to the bottom of the picker assembly, scans targets on rack components for alignment, as well as barcode labels on tape cartridges, if they are present. The picker has fingers that remove and insert tape cartridges among storage slots, tape drives, or load ports.

Figure 3 Robotics unit



1. Robotics unit
2. Lift-flex retraction handle
3. Ratchet tool
4. Robot picker
5. Lift suspension cable
6. Table assembly
7. Lift pole
8. Lift-flex cable

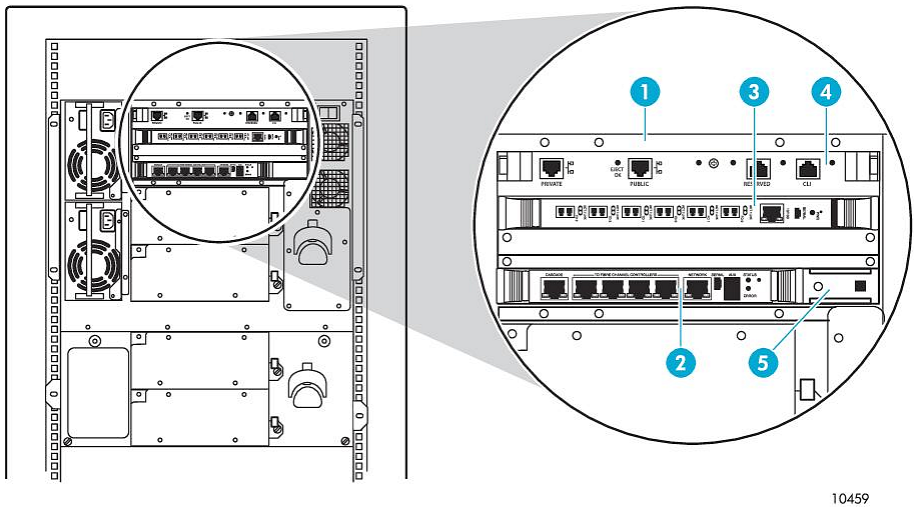
The base module has two windows on the front for viewing the robotic motion inside the library. A load port door is located to the right front (see (page 10)) where a 5-cartridge magazine can be loaded with tape cartridges for insertion into or removal from the library. The load ports are mechanical devices that enable you to import and export tape cartridges to and from the library through removable magazines, or act as additional library storage slots. These two functions for a load port cannot be mixed; you must either designate an entire load port to be import/export slots or storage slots. The base module contains a load port capable of using one 5-cartridge magazine. An operator control panel (OCP) is located at the bottom front of the base module.

The base module contains an autoranging power supply (a redundant power supply is optional), card cage, cable management features, and space for mounting up to four LTO-technology tape drives on the back.

The card cage in the base module (see (page 13)) provides six cPCI slots for the following:

- Library robotics controller (see (page 16)) A single slot, 6U-wide cPCI board having Ethernet ports and an RS-232 port. One Ethernet port connects this controller to the Interface Manager card.
- Interface Manager card (see (page 16)) A single slot, 4U-wide cPCI board having six Ethernet ports. This board contains 128MB of dynamic random access memory (DRAM) plus a 256MB CompactFlash memory card, both in their own sockets. A 2U-wide adapter panel next to the 4U-wide Interface Manager card enables it to fit in the lowest 6U-wide card cage slot.
- Interface controller A cPCI board, having two FC ports for connecting to the SAN, along with four FC ports for connecting up to four HP LTO2 or LTO3 tape drives. LTO4 and later tape drives do not connect to the interface controller; instead, they connect directly to the SAN. The interface controller is available in two speeds. The e2400-FC 2Gb interface controller has an FC speed of 2 Gbps, is 6U wide, and uses a single slot (see (page 18)). The e2400-FC 4Gb interface controller has an FC speed of 4 Gbps, is 4U wide, and uses two slots (see (page 18)).

Figure 4 Base module card cage (LTO3 tape drives shown)



1. Base module card cage
2. Interface Manager card
3. Interface controller (e2400-FC 2Gb interface controller shown)
4. Library robotics controller
5. Adapter panel

The cable management feature is a spool, mounted near the tape drives, that enables LAN and FC cables to be dressed and routed away from hot plug or hot swap components.

Expansion modules

Three expansion modules are available to increase library capacity beyond that provided by the base module. These expansions modules are:

- Tape drive expansion module
- Card cage expansion module
- Capacity expansion module

IMPORTANT: If you are adding expansion modules to an EML 71e, you must purchase a capacity upgrade license for Command View TL (part number AH063A). This license upgrades your base module from 71 slots to 103 slots. You must also make sure that your rack has side panels and doors installed to comply with regulatory requirements.

Tape drive expansion module

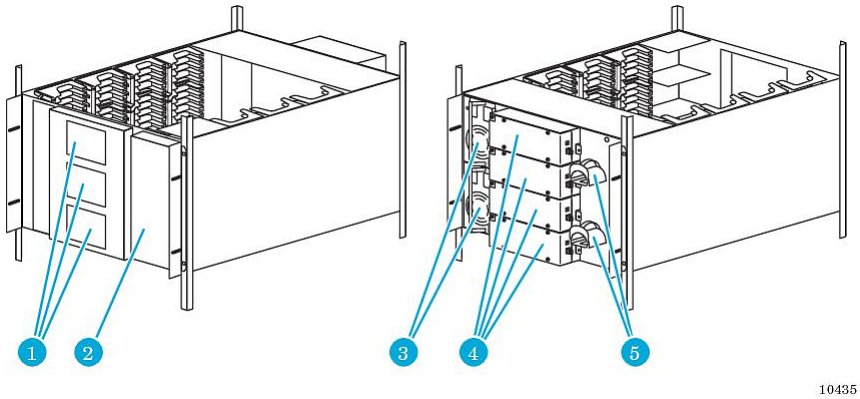
The tape drive expansion module is an 8U chassis containing 94 LTO slots (84 permanent and 10 configurable). The number of usable permanent slots depends on whether it is the bottom module in the library because the library floor is always attached to the bottom module and the floor limits the distance that the robot can travel. If the library floor is attached to the tape drive expansion module, the bottom row (containing seven slots) cannot be used.

CAUTION: Never operate the library with the floor removed. The robot can be damaged.

The tape drive expansion module has three windows on the front for viewing the robotic motion inside the library. To the right is a 10-cartridge configurable load port that holds two 5-cartridge magazines.

On the back, the module contains one primary power supply with a slot provided for another optional redundant power supply. Up to four Ultrium tape drives can be installed in the tape drive expansion module. Cable management features are provided for cable routing and dressing.

Figure 5 Tape drive expansion module



1. Viewing windows
2. 10-Cartridge load port
3. Power supplies (optional redundant power supply shown)
4. Tape drives (LTO3 tape drives shown)
5. Cable management features

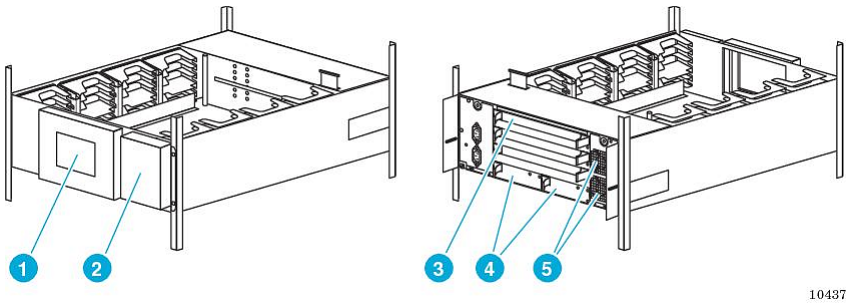
Card cage expansion module

The card cage expansion module is a 4U chassis that contains 48 permanent LTO slots and space for additional interface controllers. This module must be located directly below the top 8U tape drive expansion module. The number of usable permanent slots depends on whether it is the bottom module in the library because the library floor is always attached to the bottom module and the floor limits the distance that the robot can travel. If the library floor is attached to the card cage expansion module, the last two rows (containing 16 slots) cannot be used.

CAUTION: Never operate the library with the floor removed. The robot can be damaged.

The front of the card cage expansion module has one window for viewing robotic motion inside the library. On the back, six PCI card slots are available for additional interface controllers to expand the library tape drive capacity. One interface controller is added for every four additional LTO2 or LTO3 tape drives. LTO4 and later tape drives do not connect to an interface controller; instead, they connect directly to the SAN. Two power supplies are located at the bottom of the card cage, and two cooling fans are on the right.

Figure 6 Card cage expansion module



1. Viewing window
2. 4U blank cover
3. Card slots
4. Power supplies
5. Fans

Capacity expansion module

The capacity expansion module is an 8U chassis containing 120 LTO slots (110 permanent and 10 configurable). If the library floor is attached to the capacity expansion module, the bottom row containing 10 slots is blocked and cannot be used.

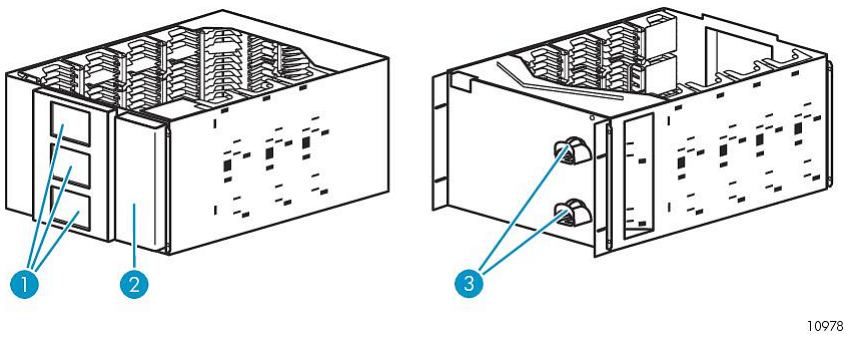
CAUTION: Never operate the library with the floor removed. The robot can be damaged.

If the capacity expansion module is placed below the base module or a tape drive expansion module, six slots at the top of the back wall cannot be used because the tape drives in the module above it prevent the robot from reaching these slots.

On the front of the capacity expansion module are three windows for viewing the robotic motion inside the library. To the right is a 10-cartridge configurable load port that holds two 5-cartridge magazines.

On the back of the capacity expansion module are cable management features for cable routing and dressing.

Figure 7 Capacity expansion module



1. Viewing windows
2. 10-Cartridge load port
3. Cable management features

Controller cards

This section explains the function of the three major cards that control the library. These cards are:

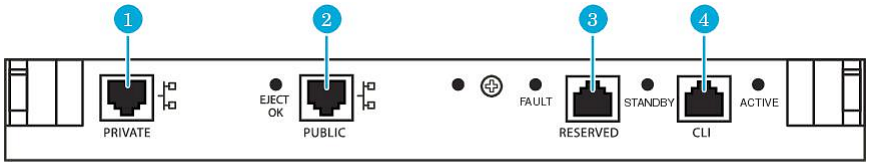
- Library robotics controller
- Interface Manager card
- Interface controller

Library robotics controller

The library robotics controller contains firmware to control the robot, communicate with the Interface Manager card, manage the library servo and vision control, and monitor the door and load port sensor status.

Robot commands are sent from hosts in the SAN to an interface controller, which directs them over an internal Ethernet network to the library robotics controller. The library robotics controller translates these commands into movements to be performed by the robot.

Figure 8 Ports on the library robotics controller

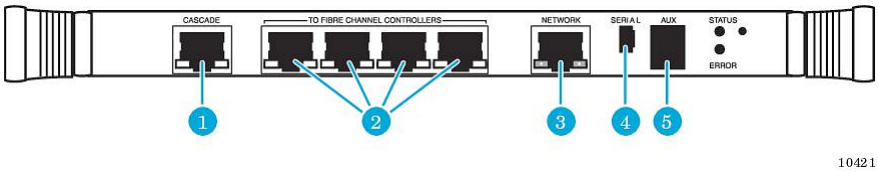


1. Private Ethernet port (not used)
2. Public Ethernet port (connection to Interface Manager card)
3. Reserved port (not used)
4. CLI port (RS-232–HP services only)

Interface Manager card

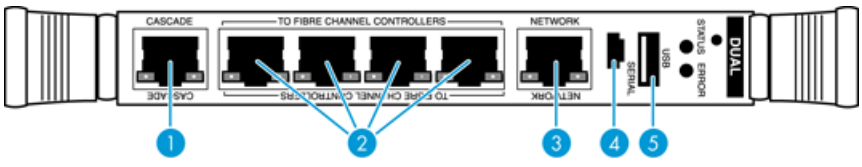
The Interface Manager card is an HP proprietary management card designed to consolidate and simplify the management of multiple interface controllers installed in the library. It also provides SAN-related diagnostics and management for library components, including the interface controllers, tape drives, and robotics. The Interface Manager card, in conjunction with HP Command View TL software, provides remote management of the library by using a serial, Telnet, or Web-based graphical user interface (GUI).

Figure 9 Ports on the Interface Manager card 342213–001 or 393531–001



1. Cascade Ethernet port (connection to library robotics controller)
2. Private Ethernet ports to interface controllers
3. Network Ethernet port (to management station)
4. Serial port
5. Auxiliary RJ-11 serial connector (not used)

Figure 10 Ports on the Interface Manager card 480240-001

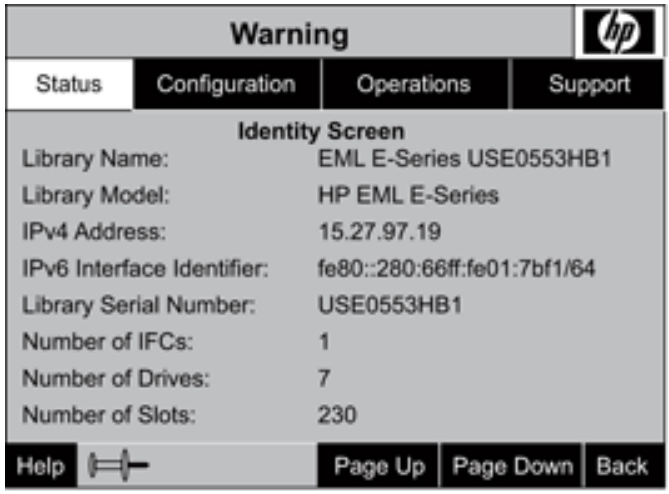


1. Cascade Ethernet port (connection to library robotics controller)
2. Private Ethernet ports to interface controllers
3. Network Ethernet port (to management station)
4. Serial port
5. USB port

The Interface Manager card communicates with the management station over the LAN. The management station is a Microsoft Windows-based PC (server) that hosts the Command View TL software. Ideally, the management station should have a static IP address, and be dedicated for use with the Interface Manager card and Command View TL software.

IP connections on the EML can be IPv4 or IPv6 format. The library can be configured to use one or both formats, but can not operate if neither protocol is enabled. View the IP connections on the Identity Screen (from the Home screen select Status, then Identity Screen).

Figure 11 Viewing IP connections from the Identity Screen



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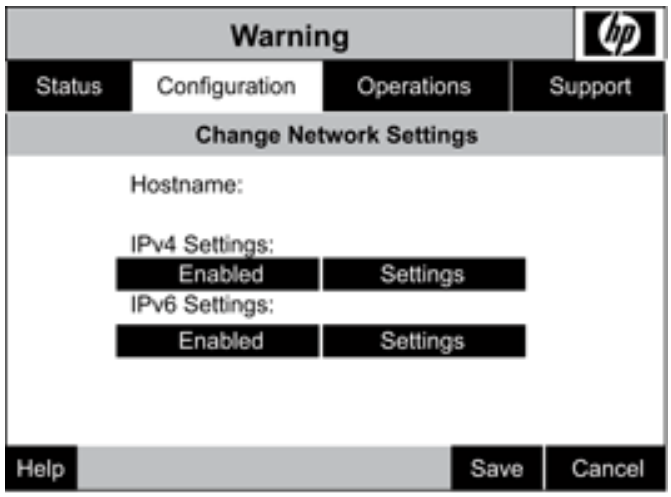
Enable or disable the protocols from the Change Network Settings screen, then view and save the settings from that same screen.

To view and change the settings for either IPv4 or IPv6:

1. From the Home screen, select Configuration.
2. From the Library Configuration menu select Change Network Settings.

Figure 12 Viewing the Change Network Settings screen



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3. To enable or disable IPv4 or IPv6, touch the appropriate Enable or Disable button.
4. To view or change the settings, touch the appropriate Settings button.

NOTE: Some settings are read-only.

5. To save any changes to the network settings, select the **Save** button at the bottom, right of the OCP.

Any client machine on the LAN can communicate with the Interface Manager card either through the GUI or through a command line interface (CLI). At a higher level, multiple libraries, each containing an Interface Manager card, can be connected to a single management station. Each Interface Manager card can communicate with only one management station, but the management station can communicate with multiple Interface Manager cards.

After being configured, the Interface Manager card is used to configure the interface controllers based on knowledge of the library and SAN. As robotics commands are received from the interface controllers, the Interface Manager card acts as a switch to relay these commands to the library robotics controller. The Interface Manager card contains on-board Flash memory to provide a persistent history of the library and storage network health.

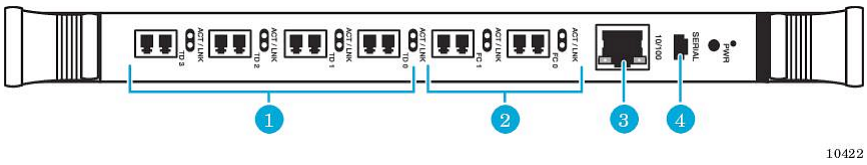
Interface controller

The interface controller is an HP proprietary card that provides FC connectivity for LTO2 and LTO3 tape drives and robotics in the SAN. Commands, data, and status information are transferred to and from this controller, from hosts, the robot, and the LTO2 and LTO3 tape drives. One interface controller can manage up to four LTO2 or LTO3 tape drives.

LTO4 and later tape drives do not connect to an interface controller; instead, they connect directly to the SAN. Libraries that contain only LTO4 or later tape drives still need one interface controller which is used to direct commands to the robot. The interface controller is available in two speeds: 2 Gbps and 4 Gbps.

Ports on the e2400-FC 2Gb interface controller

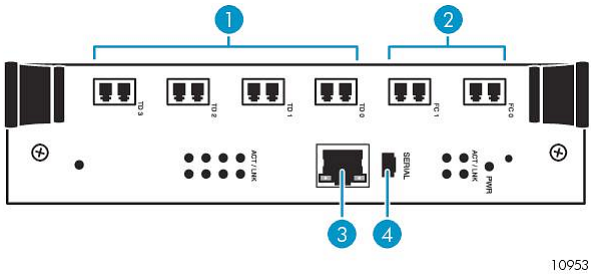
Figure 13 Ports on the e2400-FC 2Gb interface controller



1. FC ports to LTO2 and LTO3 tape drives
2. FC ports to hosts
3. Ethernet port (connection to Interface Manager card)
4. Serial port

Ports on the e2400-FC 4Gb interface controller

Figure 14 Ports on the e2400-FC 4Gb interface controller



1. FC ports to LTO2 and LTO3 tape drives
2. FC ports to hosts
3. Ethernet port (connection to Interface Manager card)
4. Serial port

Changing the master controller (SIPP master)

One interface controller is assigned by the Interface Manager card as the *master* controller the SIPP master. Only the SIPP master is designated to send commands to the library robotics controller. If multiple interface controllers are present, Command View TL software, through the Cabling View, can be used to determine which one is acting as the SIPP master. Changing the SIPP master requires a service-level password and command using the CLI (Telnet or serial). The commands are:

SERVICE *L&TTPASSWORD*
SET IPCONNECTION INTERFACE MASTER *X*

, if the IM firmware is i182 or lower

SERVICE *L&TTPASSWORD*
SET IPCONNECTION MASTER *X*

, if the IM firmware is I200 or higher

where *L&TTPASSWORD* is the Library and Tape Tools (L&TT) password and *X* is the interface controller number. Obtain the password from the web site L&TT web siteby calling HP Support to get a 2–day ltt service password. Find the interface controller number by using the **SHOW INTERFACE INFO ALL** CLI command.

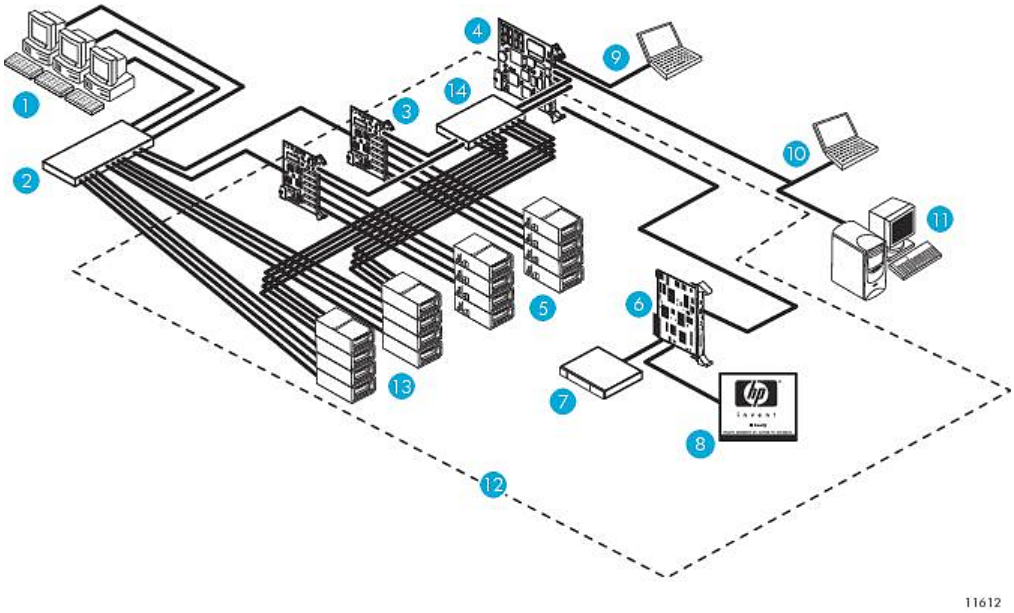
If the master interface controller (designated SIPP master) is replaced, the Hardware Replacement wizard sets up the SIPP master. If the master interface controller (designated SIPP master) is moved to another interface controller in the library, perform the following manual service steps:

1. Remove all partitions.
2. Remove all host maps.
3. Log in to the CLI and obtain service-level access.
4. Use the **SET IPCONNECTION MASTER X** command to make a particular interface controller the SIPP master. Currently, the Interface Manager card does not automatically failover an interface controller, even if the previous SIPP master is missing.
5. Reconfigure maps and partitions.

Functional description

The library receives commands and data throughout the SAN from hosts running applications from approved independent software vendors (ISVs). Host bus adapters (HBAs) in servers send this traffic over FC links, usually through FC switches. For LTO4 and later tape drives, the traffic goes directly to the tape drive; but for LTO2 and LTO3 tape drives, the traffic first goes through an interface controller. One interface controller can connect up to four LTO2 or LTO3 tape drives. For all libraries, regardless of whether they contain LTO2 and LTO3 or LTO4 and later tape drives, at least one interface controller is required to pass tape cartridge changer (robotics) commands to the Interface Manager card over a private network. The Interface Manager card passes these SCSI commands on to the library robotics controller over the private network, taking advantage of the error handling and retry capabilities of TCP/IP.

Figure 15 Library network



1. Hosts
2. FC Switch (SAN)
3. Interface controller
4. Interface Manager card
5. LTO2 or LTO3 tape drives
6. Library robotics controller
7. Robot
8. OCP
9. Serial connection
10. Telnet connection
11. Management station
12. Library boundary
13. LTO4 and later tape drives
14. Switch for the internal network

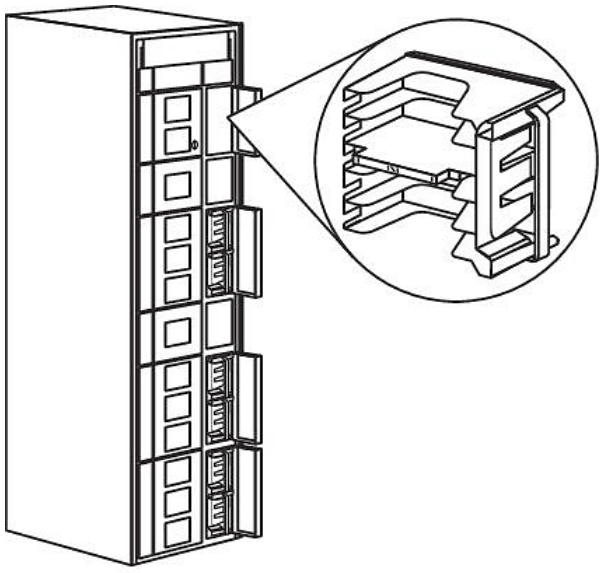
In addition to receiving traffic from the interface controllers, the Interface Manager card receives command and diagnostic requests over an Ethernet connection from three other possible sources. The majority of requests come from a management station where Command View TL software resides. The other two sources are through a Telnet session or a serial interface. The Interface Manager card works in the background to manage library functions. It configures the interface controllers to direct commands from host systems to the appropriate LTO2 or LTO3 tape drive or to the library robotics controller.

The library robotics controller receives commands over an internal private network and from the OCP. It manages robotics movement, monitors the door and load port sensor status, and stores library information in volatile memory.

Load ports and magazines

The load ports are mechanical devices on the front of the library that enable you to import and export tape cartridges to and from the library through removable magazines, or act as additional library storage slots. These two functions for a load port cannot be mixed; you must either designate an entire load port to be import/export slots or storage slots. The base module contains a load port capable of using one 5-cartridge magazine. The 8U expansion modules contain load ports capable of using two 5-cartridge magazines each.

Figure 16 Library load ports on 40U configuration



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Tape drives

The Ultrium tape drive is a high performance streaming tape drive that uses LTO technology. The library can use Ultrium 460 (LTO 2), Ultrium 960 (LTO 3), Ultrium 1840 (LTO4), Ultrium 3280 (LTO5) and Ultrium 6650 (LTO6) tape drives.

The Ultrium 960 and later include support for both rewriteable and Write-Once, Read-Many (WORM) tape cartridges. WORM tape cartridges provide an enhanced level of data security against alteration of data because you cannot erase or overwrite them. To check whether your backup or archive software application supports WORM tape cartridges, see the following web site: http://www.hp.com/go/connect.

For optimum performance, always use a tape cartridge that matches the specifications of your tape drive. You can find comparisons between the Ultrium tape drives in (page 86).

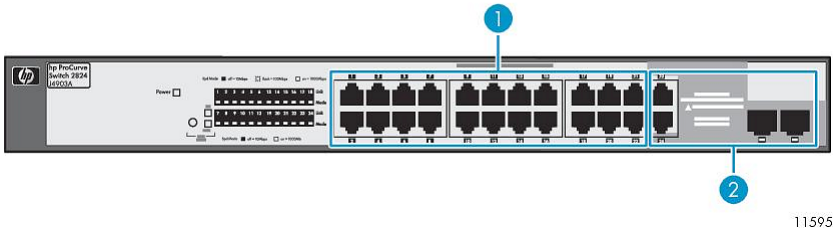
Tape cartridges and cleaning cartridges are specifically formatted for use with Ultrium drives. To order Ultrium tape cartridges, see "Ordering HP tape cartridges and barcode label packs" (page 102).

Switch for the internal network

CAUTION: Do not connect this switch to your local LAN. It is for internal library use only. Connecting this switch to the LAN could cause library components to perform incorrectly or report failures.

The 24-port Ethernet switch provides a private management network to connect the Interface Manager card to the LTO4 or later tape drives. You must install one switch in each library that contains LTO4 or later tape drives.

Figure 17 Ports on the switch for the internal network



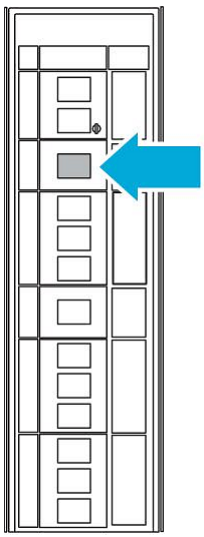
1. 10/100Base-TX RJ-45 ports

Operator control panel

The OCP displays library status information and enables you to access the library menus with a touch screen. Use these menus to view and change the library settings, move tape cartridges, obtain status information, or run diagnostic tests. Functions provided by the OCP are:

- Robotic and tape drive firmware revision reporting
- Library configuration
- Library and tape drive serial number reporting
- Critical component status report
- Critical component failure notification
- Ability to move tapes to and from any location
- Ability to configure barcode label length and justification reporting to the front panel and to the host
- Access to error information
- Adjust screen contrast

Figure 18 Location of the OCP



Numbering

All of the tape cartridge slots and tape drives in a library are numbered with a coordinate system. You might see these numbers in your application software or in error or diagnostic messages. Error

messages often include a slot location in the format `MRC x,y,z`. This identifies a module (*x*), row (*y*), and column (*z*) location.

Each module has a different number of available slots, but a common numbering scheme for identifying the slot location.

The library numbers the LTO slots using the following scheme:

- In general, the library numbers the slots one module at a time, starting with the top module. For slot numbering purposes, the 12U base module is considered to be two modules: an 8U base module and a 4U base module.
- Within each module, column numbering starts with 1 at the left column as viewed from the front of the library.
- Within each module, row numbering starts with 1 at the top row.
- Any reserved slots, located in the first column of the 8U base module, and taking up as many as nine slots, are not included in the numbering scheme. A common use for reserved slots is for holding cleaning cartridges.

  NOTE: Reserved slots are not available on the EML 71e.

- If the load port slots are configured as import/export slots, they are skipped and not counted in the numbering of storage slots. If the load port slots are instead configured as storage slots, they are counted in the numbering scheme.

  NOTE: Reconfiguring the load port slots for either import/export or storage changes the slot numbering in any lower modules the next time you perform an inventory.

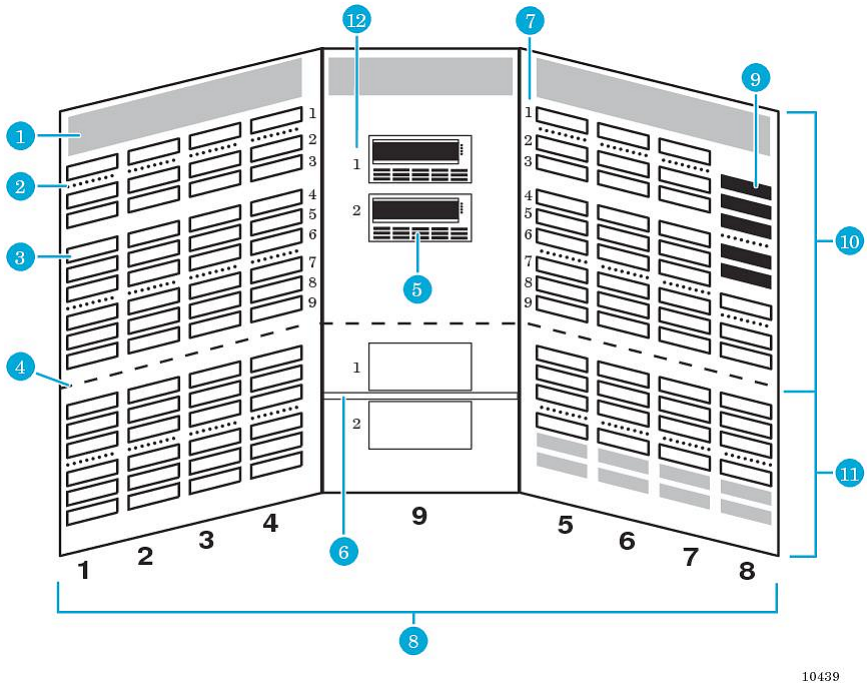
- Some slots are not available in the bottom module in the library because the floor limits the distance that the robot can travel.

  CAUTION: Never operate the library with the floor removed. The robot can be damaged.

The slot numbering for various modules are shown on the following pages:

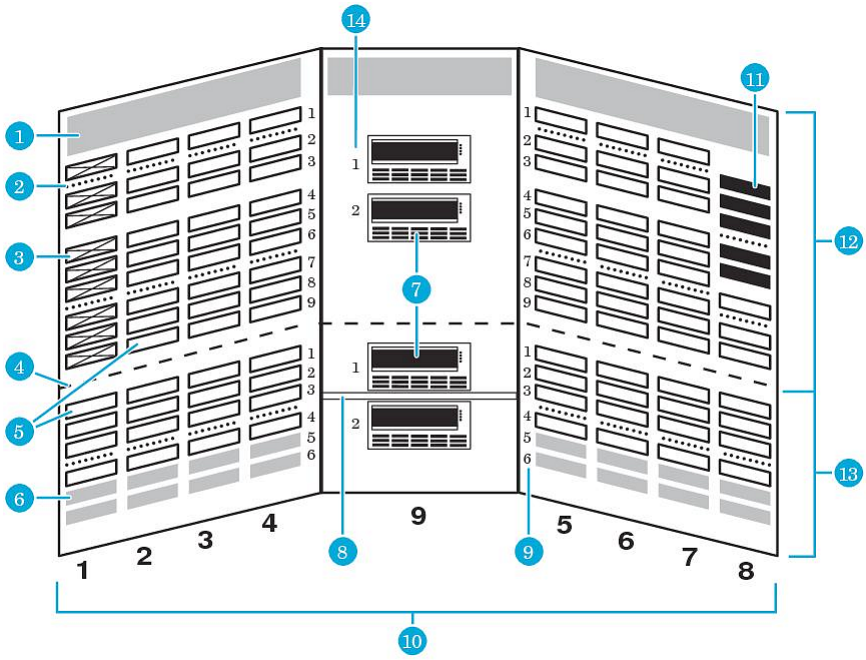
- Base module of the EML 71e ((page 24))
- Base module of all other configurations ((page 25))
- Tape drive expansion module ((page 25))
- Card cage expansion module ((page 26))
- Capacity expansion module ((page 26))

Figure 19 Slot numbering in the base module for the EML 71e



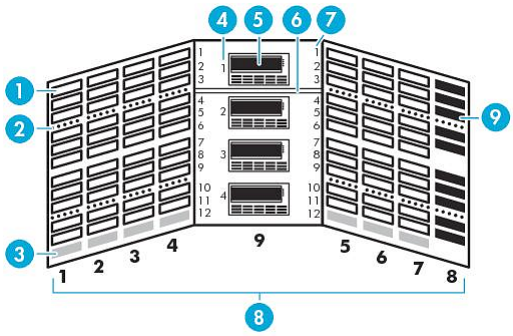
1. Robot park zone
2. Array targets for the barcode scanner
3. Slots available for data cartridges
4. Software demarcation between upper and lower modules for slot counting purposes
5. Tape drives
6. Expansion identification label
7. Row numbering
8. Column numbering
9. Load port slots
10. 8U base module
11. 4U base module
12. Tape drive numbering

Figure 20 Slot numbering in the base module for all other EML configurations



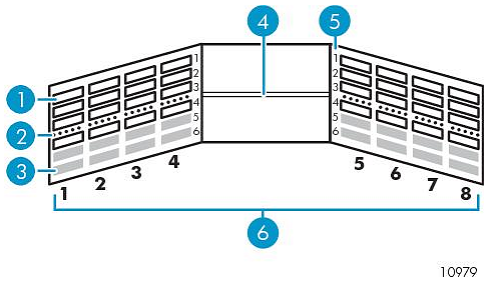
1. Robot park zone
2. Array targets for the barcode scanner
3. Reserved slots-can be used for cleaning cartridges or data cartridges
4. Software demarcation between upper and lower modules for slot counting purposes
5. Slots available for data cartridges
6. Slots unavailable for use when the library floor is installed in this module
7. Tape drives
8. Expansion identification label
9. Row numbering
10. Column numbering
11. Load port slots
12. 8U base module
13. 4U base module
14. Tape drive numbering

Figure 21 Slot numbering in the tape drive expansion module



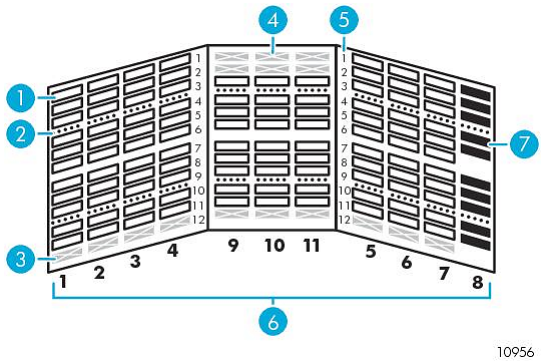
1. Slots available for data cartridges
2. Array targets
3. Slots unavailable for use when the library floor is installed in this module
4. Tape drive numbering
5. Tape drives
6. Expansion identification label
7. Row numbering
8. Column numbering
9. Load port slots

Figure 22 Slot numbering in the card cage expansion module



1. Slots available for data cartridges
2. Array targets
3. Slots unavailable for use when the library floor is installed in this module
4. Expansion identification label
5. Row numbering
6. Column numbering

Figure 23 Slot numbering in the capacity expansion module



1. Slots available for data cartridges
2. Array targets
3. Slots unavailable for use when the library floor is installed in this module
4. Slots unavailable for use when a base module or tape drive expansion module is above this module
5. Row numbering
6. Column numbering
7. Load port slots

Command View TL

Command View TL provides a browser-based GUI for remote management and monitoring of the Interface Manager card through a LAN. Command View TL is the preferred method for controlling the Interface Manager card. In conjunction with the Interface Manager card, Command View TL provides the following:

- Configuration and management of the Interface Manager card and FC interface controllers
- Management of the entire library system
- Hardware inventory and identity information
- Status information for connected hardware
- Error reporting and comprehensive error logs
- Firmware management
- License management

Command View TL is installed on a management station and communicates with the Interface Manager card through the LAN. The management station processes information from the Interface Manager card and *serves up* the Command View TL GUI. You can access Command View TL from

the management station directly, or through any client on the LAN using a browser-based GUI. Multiple Command View TL clients can be simultaneously open across the LAN, and multiple libraries can be managed through the Command View TL software.

See the Command View TL documentation at http://www.hp.com/support/cvtl for prerequisites, installation, and operating instructions.

IMPORTANT: If you are upgrading an EML 71e, you must purchase a capacity upgrade license for Command View TL (part number AH063A). This license upgrades your base module from 71 slots to 103 slots.

Library and Tape Tools

Library and Tape Tools (L&TT) is a collection of storage hardware management and diagnostic tools assembled into a single, convenient program. L&TT offers a GUI or command screen interface (CSI), enabling you to perform the following functions with the library:

- **Installation check** Guides you through a basic installation check of the library. The software helps you choose an appropriate HBA, making sure that the device is detected by the system, and verifying key device functionality.
- **Device identification** Identifies the storage products connected to the system, along with key information on product configuration and status.
- **Troubleshooting tests** Provides various tests to verify product functionality or to isolate product issues. Tests include device self-tests, read/write tests on tape drives, exerciser tests for autoloaders and libraries, and specific device utilities.
- **Support ticket generation** If you experience a problem with a storage product, L&TT can generate a support ticket that includes essential information for troubleshooting the problem.
- **Automatic notification of Web updates** If a connection to the Internet is present and Web updates are enabled in the tool preferences, L&TT automatically informs you of the following updates, if available, each time the program is started:
  - New versions of L&TT
  - New firmware files for connected devices
  - New device-specific functionality (such as new or updated tests) for connected devices

For more information on L&TT, go to the web site http://www.hp.com/support/tapetools.

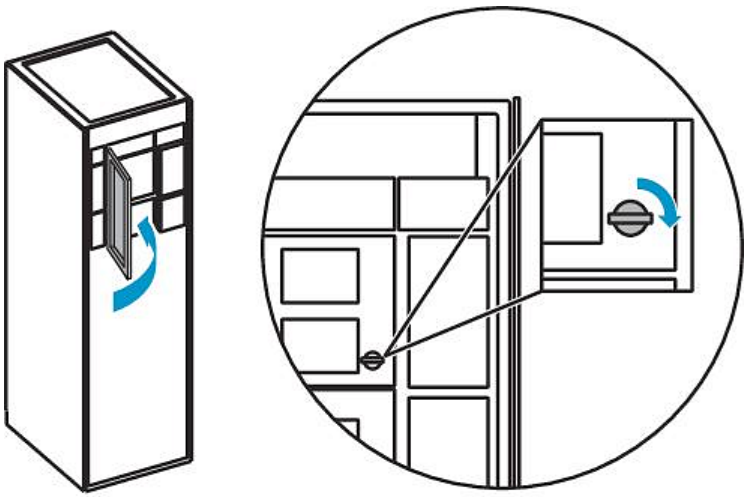
2 Using the library

This chapter describes operating procedures for the library.

Powering on the library

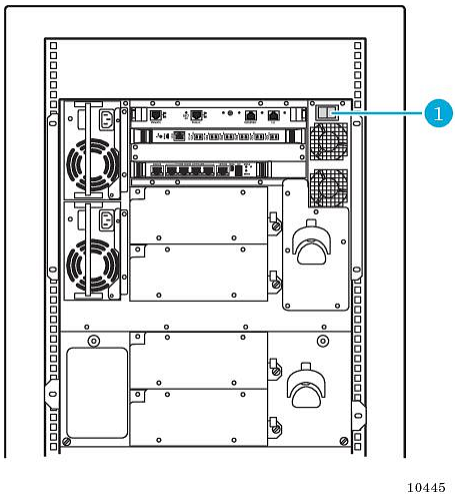
1. Close the center door of the library and turn the center-door knob one-quarter turn clockwise to lock it.

Figure 24 Closing the center door



2. At the back of the library, press the library main power switch to the **I** (On) position.

Figure 25 Library main power switch control



1. Library main power switch

NOTE: The following step applies only when the library is powered on for the first time or when a new interface controller is installed. This step is necessary to put the interface controller into managed mode.

3. If this is the first time the library has been powered on after delivery, or if a new interface controller was installed, configure the interface controller so that it is recognized by the Interface Manager card. Do one of the following:
   - If your library has an e2400-FC 2Gb interface controller, wait approximately two minutes, and turn off the main power switch. Wait several seconds and then turn on the power switch again.
   - If your library has an e2400-FC 4Gb interface controller, reset the interface controller *twice*. To reset the interface controller, insert a paper clip into the reset hole. After resetting the interface controller, wait three minutes, then reset it again.

NOTE: A 71e library requires approximately 15 minutes to initialize. All other library models require up to an hour to initialize and do an inventory. Nothing appears on the OCP for the first few minutes of this process.

Powering off the library

1. Use your backup software to stop all library activity and make sure the picker is empty.
2. On the OCP, select the **Operations→Unlock Door** command to park the robot.
3. After the robot is parked, press the main power switch ((page 28)) to the **O** (Off) position.

Center-door interlock

The center door on the front of the library cannot be opened until a password-protected command to unlock the center door is selected on the OCP. This command parks the robot, and actuates a lever that enables you to open the center door. Even if the unit is powered off, the robot must be parked before you can open the center door. If the robot is not parked prior to removing power, you cannot readily open the center door.

Performing an inventory

The library does an inventory at three different times:

- When you turn on the power to the library
- When you reboot the library (**Operations→Reboot Library**)
- When you open and close the center door of the library (**Operations→Unlock Door**)

During the inventory:

- The library robotics controller applies voltage to the motors (picker, reach, wrist, and lift drive) to obtain range of motion for each motor.
- The range of motion of the robot is tested.
- The targets and labels are read for calibration purposes.
- The barcode scanner looks at each slot to see if it contains a tape. The library robotics controller stores this information. You must configure the library to use or not use barcode labels (**Configuration→Library Configuration→Configure Inventory Mode**). If barcode labels are not used, the inventory time may take as long as an hour, and a tape cartridge in a slot is only known to the library as being full.

Attaching barcode labels to tape cartridges

Attaching barcode labels enables the library and application software to identify the tape cartridge quickly, thereby speeding up inventory time. When a barcode label is not used, the library simply designates that tape slot as being full. Even though the library functions without barcode labels,

HP recommends that you use them on your tape cartridges. Your host software can use barcode labels to track the following information:

- Date of format or initialization
- Media pool of tape
- Data residing on the tape
- Age of the backup
- Errors encountered while using the tape (to determine if the tape is faulty)

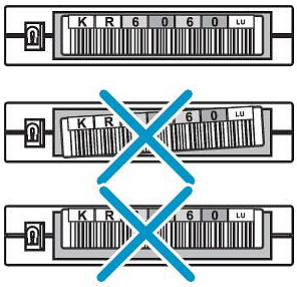
CAUTION: Handle tape cartridges with care. Do not drop or mishandle them, or place them near sources of electromagnetic interference. Rough handling can damage the tape cartridge making it unusable and potentially hazardous to the tape drives.

CAUTION: The misuse of barcode technology can result in backup and restore failures. To ensure that your barcodes meet HP's quality standards, always purchase them from an approved supplier and never print barcode labels yourself. For more information, see the order form provided with the library, as well as the *Barcode Label Requirements, Compatibility and Usage* white paper available from http://www.hp.com/support.

NOTE: For information on ordering tape cartridges and barcode labels, see "Ordering HP tape cartridges and barcode label packs" (page 102).

Ultrium tape cartridges have a recessed area located on the face of the tape cartridge next to the write-protect switch. Use this area for attaching the adhesive-backed barcode label. Only apply labels onto the tape cartridge in this designated area. For successful operation of your tape library, place the barcode label *entirely* within the recessed area, making sure that no part of the label extends outside.

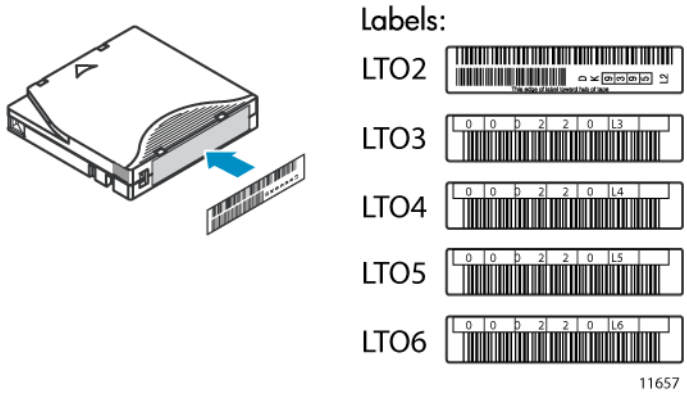
Figure 26 Proper barcode label placement



Position the barcode label as shown in the following figure, with the alphanumeric portion facing the hub side of the tape cartridge (LTO2) or numeric portion away from the hub (LTO3 and later). Never apply multiple labels onto a tape cartridge, because extra labels can cause the tape cartridge to jam inside a tape drive.

Always use the proper barcode labels for your tape drive technology. An L2 (Ultrium 460), L3 (Ultrium 960), L4 (Ultrium 1840), or L5 (Ultrium 3280), L6 (Ultrium 6650) identifier is located at the end of the 8-character Ultrium barcode labels on data cartridges. The universal LTO cleaning cartridges have a CLN and L1 identifier on the label.

Figure 27 Attaching an Ultrium barcode label

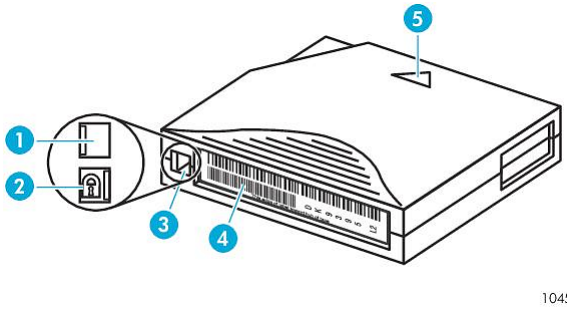


Setting the write-protect switch

Each tape cartridge has a sliding write-protect switch. This switch determines whether new data can be written to the tape cartridge (write-enabled) or whether data on the tape cartridge is protected from being erased or overwritten (write-protected).

By moving the switch to the left, the tape cartridge is write-enabled. By moving the switch to the right, the tape cartridge is write-protected.

Figure 28 Write-protecting Ultrium tape cartridges



1. Write-enabled
2. Write-protected
3. Write-protect switch
4. Barcode label
5. Insertion arrow

Inserting tape cartridges into the load port

Inserting tapes through the center door of the library should only be done when bulk loading. At all other times, load tape cartridges into the library through the load port. Not using the load port stops all robotic activity and tape movement, and requires a complete library inventory before operations can resume. When using the load port, tape cartridges are inserted into 5-cartridge magazines, which are placed into either the 5-cartridge load port or a 10-cartridge load port. To use a load port:

1. Attach a barcode label to each tape cartridge (see (page 29)).
2. Write-protect or write-enable each tape cartridge as appropriate (see (page 31)).
3. On the OCP, select **Operations→Unlock Load Ports**. If the load ports are password protected and you are prompted to enter the password, use the keypad that appears on the OCP to enter the password, then press the **Enter** key on the touchscreen. All load port doors open.

4. Grab the handle on the magazine and pull it out of the library.

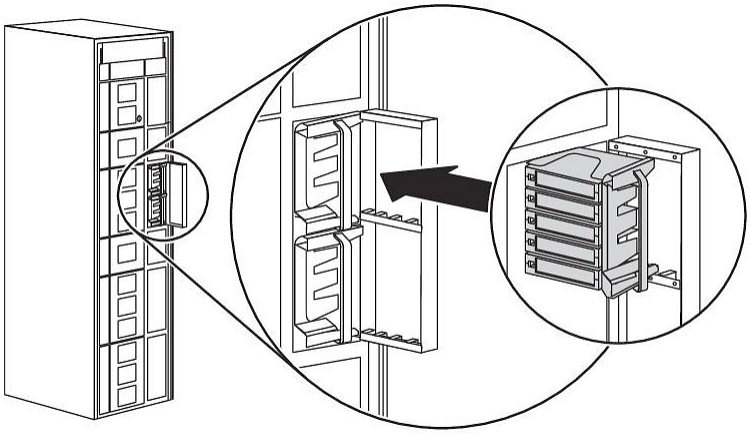
CAUTION: Guard plates prevent access to the inside of the library when a load port magazine is removed. These doors will move back out of the way when a magazine is reinserted. You should not attempt to otherwise move these guards, nor gain access to the library through the load ports.

5. Insert the tape cartridges into any available slots in the magazine.

CAUTION: Excessive force when inserting a magazine can cause a tape cartridge to unseat and extend into the path of the robot.

6. Align the magazine with the track on the load port door and gently slide the magazine through the spring door and fully into the load port.
7. Close the load port door.
8. After all load port doors are closed, the library does an inventory of the load ports.

Figure 29 Inserting a magazine into the load port



Using the OCP

The OCP is an LCD screen located on the front of the library that is operated by touch. The icons, text, and tabs on the OCP enable you to obtain information about the library, execute library commands, and test library functions.

OCP icons

The following table displays icons that can appear on the OCP.

Table 2 OCP icons

Icon	Description
	Critical error—A component failure has made the library inoperable.
	Warning—A component failure has degraded library activity, but the library is still operable.
	Ready—The library is online and ready for operation.
	Thumbtack out—The screen is eligible to be selected for display after a period of inactivity.

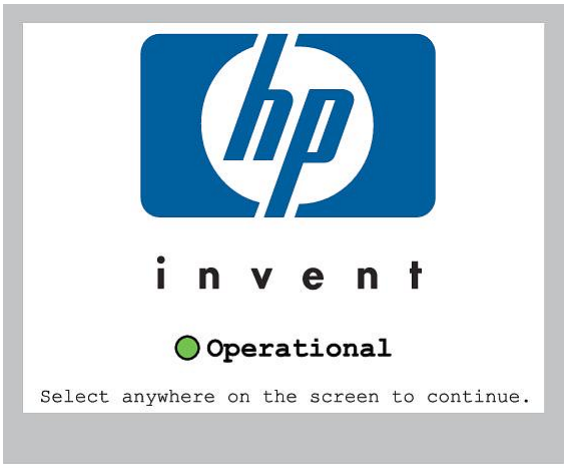
Table 2 OCP icons *(continued)*

Icon	Description
	Thumbtack in—The screen has been selected for display after a period of inactivity. Only one screen at a time can be thumbtacked.
	Item selection—The item can be selected from a menu list.
	Password required—A password is required to access this feature.
	Password entered—The correct password has been entered. The command is available.

Home screen

The first screen that appears after library initialization is the Home screen. After the library status is determined (ready, warning, or error), that status appears on the Home screen, and you can touch the screen to access other functional and operational screens.

Figure 30 Home screen



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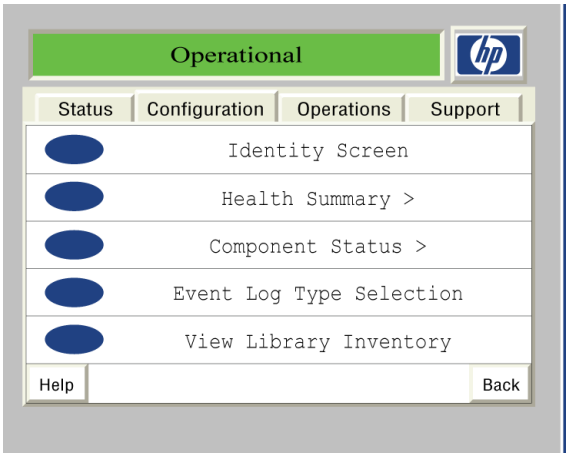
OCP tabs and status bar

After touching the Home screen, the menu screen appears. All menu screens contain a status bar to the left of an HP logo, two rows of tabs, and an area for detailed screen information in the center.

Figure 31 Menu screen



The status bar is a quick indicator of library health. The bar is green when the library is functioning normally, yellow during a warning condition, and red during an error condition. Touching the status bar takes you to the Health Summary screen.

The detailed functions of the four top-level menu tabs (Status, Configuration, Operations, and Support) are discussed later. Selecting any of these four tabs takes you to menu items under that screen category.

Five navigation tabs can be displayed at the bottom of the screen. The thumbtacked (in or out) tab was discussed in (page 33). The remaining tabs are:

- **Help** Displays help text for features appearing on that screen.
- **Page Up** Scrolls text to a previous page when text is longer than a page in size.
- **Page Down** Scrolls text to the following page when text is longer than a page in size.
- **Back** Moves you one level up in the menu tree. All screens except the Home, test status, error message, and keypad screens have this tab at the lower, right corner. Returning to the Home screen removes all password privileges previously granted through the OCP.

Timeouts

The library enters a timeout state after five minutes of inactivity. In this state:

- The OCP backlight turns off.
- Password privileges are removed on all screens granted access.
- The OCP returns to either the Home screen or a thumbtacked screen, if one is designated. If a thumbtacked screen consists of more than one page, the pages cycle every five seconds.

Touching a screen in a timeout state turns on the backlight. Subsequent touches after the backlight is lit perform the requested command.

The following are special timeout cases:

- When a service password is entered, the length of time to enter a timeout state changes from 5 minutes to 30 minutes. If the OCP is touched during the 30-minute period, the library reverts to a normal 5-minute period before a timeout.
- If a warning condition occurs while the library is timed-out, the backlight comes on for 30 minutes. If the OCP is touched during this 30-minute period, the library reverts to a normal 5-minute period before a timeout. Otherwise, the library re-enters a normal timeout state after 30 minutes.
- If an error condition occurs while the library is timed-out, the backlight comes on for 60 minutes. If the OCP is touched during this 60-minute period, the library reverts to a normal 5-minute

period before a timeout. Otherwise, the library re-enters a normal timeout state after 60 minutes.

For certain functions, the timeout feature is disabled and re-enabled when the function completes. This occurs:

- During an operation and until the operation completes. For example, the OCP does not time out while a tape drive cleaning operation is in progress but waits for the operation to complete before starting the 5-minute timeout counter.
- While displaying the results of any test operation. Select the **Cancel** or **OK** button to return to the test menu screen.
- When displaying an error report or menu after an error. The screen is treated as temporarily thumbtacked, which clears the password protected screens after the normal timeout period, but displays the screen until it is acknowledged.
- When success or failure messages appear for an operation. The screen is temporarily thumbtacked, clearing the password protected screens after the normal timeout period, but the screen remains until acknowledged.

OCP functions

The OCP enables you to perform various functions on the library. Table 3 (page 36) provides a list of the OCP functions available from the Home screen.

Table 3 OCP components

Tab	Options to view or select
Status	Identity Screen

	Health Summary >
	• Library and Robotics >
	  ◦ Library Status
	  ◦ Robotics Status
	  ◦ Power Supply Status > (power supplies 1–6)
	• Load Ports > (load ports 1–4)
	• Drives > (drives 1–16)
	• Interface Controllers > (interface controllers 1–4)
	• Interface Manager

	Component Status >
	• Library and robotics Status >
	  ◦ Library Status
	  ◦ Robotics Status
	  ◦ Drive Odometers
	  ◦ Load Port Door Status
	  ◦ Library Sensors > (modules 1–4)
	• Individual Drive Status
	• All Drive Summary
	• Interface Controller Status > (interface controllers 1–4)
	• Interface Manager Status

	Event Log Type Selection
	View Library Inventory

Configuration	Library Configurations >
	• Change Password
	  ◦ Load Port Access Password Option
	• Configure Load Ports
	• Change Network Settings
	• Configure Barcode Reporting Formats >
	  ◦ Format for front panel reporting
	  ◦ Format for host reporting
	• Configure Reserve Slots
	• Configure Inventory Mode

	Adjust Screen Contrast
Operations	Unlock Load Ports
	Unlock Door

Table 3 OCP components *(continued)*

Tab	Options to view or select
	Reboot Library
	Media Operations > • Move Tape • Clean Drive

	Run Admin Tests >
	• Operator Control Panel >
	  ◦ Align Touch Screen
	  ◦ Panel Colors
	  ◦ Panel Pixel Test
	  ◦ Panel Firmware Version
	  ◦ Turn Backlight Off
	• Inventory Library
	• Run Demo
	• Run Self Test
	• Slot Test
	• Drive Load/Unload Test
	• Force Rewind Unload Test
	• Recalibrate Library

Support	HP Support Info
	Service Menu >
	Contact Information
	Display Library Time

Status screen

The Status screen provides access to the current state of every library component.

Power supplies, load ports, tape drives, and interface controllers are all numbered from top to bottom in the rack. However, power supplies are numbered by slot, so if a slot is not filled with a power supply, the slot still receives a number. For example, the top power supply slot in the rack is power supply 1. The power supply slot under that is power supply number 2. If a power supply is on the same level horizontally (like those in the card cage expansion module), the one to the right (facing the back of the rack) has the next highest number. If a component is removed, the numbering does not change until you reboot the library. After a reboot, the library rediscovers all components and reassigns numbers from top to bottom.

Figure 32 OCP Status screen

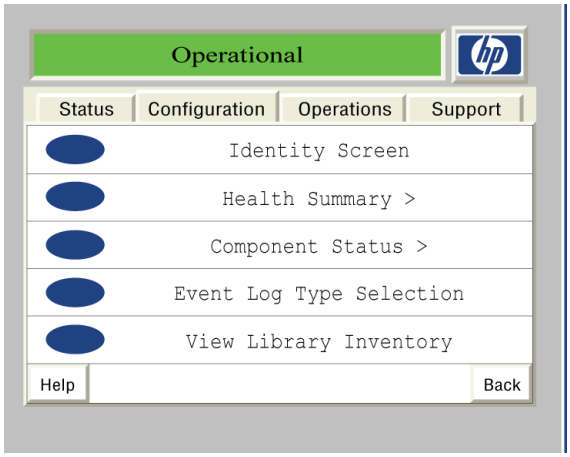


Table 4 Status screen functions

Function	Description
Identity Screen	Contains basic configuration information. The library name, IPv4 address, and IPv6 Interface Identifier are obtained from Command View TL. Other information comes from the robot firmware. The number of interface controllers and tape drives installed in the library are listed, as well as the total number of available storage slots. For example, load port slots configured as storage slots are counted in the total of available slots, while load ports used to move tape cartridges in and out of the library are not counted in the total. This screen also shows the library model, library serial number, and library firmware version.
Health Summary	Displays a status icon and health information for the library and individual components: • Library and Robotics—Displays the health status of the library, robotics, and each power supply in the library. • Load Ports—Provides the health status of each load port in the library. • Drives—Provides the health status of each drive in the library. • Interface Controllers—Provides the health status of each Interface Controller in the library. • Interface Manager—Provides the health status of the library Interface Manager.
Component Status	Identifies the status of the overall library and individual components: • Library and Robotics Status—Displays library and robotics characteristics, the tape drive odometer, the status of the load port doors, and the status of the library sensors. The odometer counts the number of loads for each tape drive. The load count is reset when a tape drive is replaced. • Individual Drive Status—Displays detailed tape drive information for each tape drive on individual screens. Select the Page Up and Page Down tabs to move between available tape drives. • All Drive Summary—Displays an overall status of all installed tape drives and whether they contain tape cartridges. • Interface Controller Status—Displays the status for individual interface controllers, showing the number of host ports, device ports, and firmware revision. • Interface Manager Status—Displays health and configuration characteristics of the Interface Manager card.

Table 4 Status screen functions *(continued)*

Function	Description
Event Log Type Selection	Enables you to filter informational, warning, and critical events. The five most recent events of any category are listed with the oldest listed first and the most recent listed last. Filtering events does not remove them from the log.
View Library Inventory	Identifies the status of each tape drive and slot location.

Configuration screen

The Configuration screen provides administrator access to screens that enable you to change the library configuration and enables any user to adjust the contrast of the OCP screen.

Figure 33 OCP Configuration screen

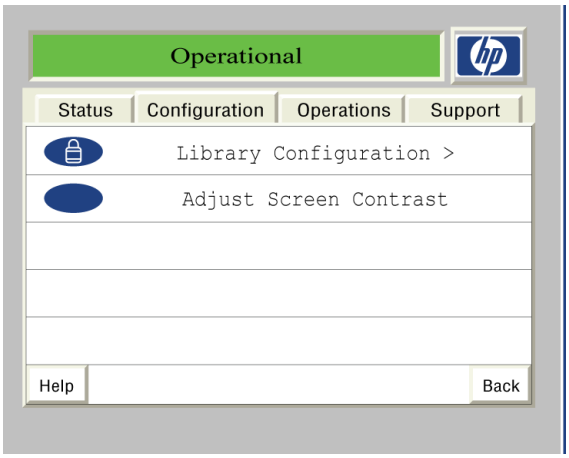


Table 5 Configuration screen functions

Function	Description
Library Configuration	enables the following items to be configured: • Change Password—The library ships with a null password. Passwords must be set to exactly eight characters, consisting of the numbers 0 through 9 and the period character. The password can be required to unlock load ports. If you forget your password, contact HP support. HP support can generate a temporary password that will enable you to access the library. Change Password is also used to set whether the admin password is required to unlock the library load ports from the OCP. After entering the existing or a new password (**Configuration+Library Configuration→Change Password**), the **Load Port Access Password Option** screen appears and indicates whether the password is required or not. To toggle the setting to require the password, press the box containing the text OCP admin password NOT required for load port access. If the box already contains the text OCP admin password required for load port access, the password is already required. (Press the text box again, if appropriate, to disable password protection of the load ports.) Press the **Save** button on the OCP. • Configure Load Ports—Shows the number of installed load ports and enables you to toggle between using each as a load port or for tape slots. Configure it as a **Load Port** to move tapes in and out of the library. Configure as **Slots** to increase the number of storage slots in the library. Changing a load port configuration causes a library reboot. • Change Network Settings—Configures the network settings for the Interface Manager card, which can be automatically set with DHCP (IPv4 DHCP is default), IPv4 static address, or variety of IPv6 addresses.

Table 5 Configuration screen functions *(continued)*

Function	Description
	Both IPv4 and IPv6 can be enabled, but both cannot be disabled at the same time. • Configure Barcode Reporting Formats—Defines how barcodes appear on the OCP and sent to the host. Barcode reporting can be configured as 6 to 8 characters and left or right aligned. If 6 characters with left alignment is chosen, any characters after the six are truncated. With 6 characters and right alignment, only the last six characters are shown with the beginning characters truncated. • Configure Reserve Slots Up to nine slots can be reserved for special purposes, such as cleaning tapes. The default is none. Select the number you want to reserve and select **Save**. **NOTE:** Reserve slots are not available on the EML 71e. • Configure Inventory Mode enables you to require barcodes on tape cartridges, or to make them optional. Requiring barcodes significantly shortens inventory time.
Adjust Screen Contrast	Use the up and down arrows to adjust the screen contrast. The screen refreshes each time an arrow is pressed. Select the **OK** button when finished.

Operations screen

The Operations screen provides access to screens that enable you to unlock load ports, unlock the library door, reboot the library, move tapes, clean tape drives, and run administrative tests.

Figure 34 OCP Operations screen

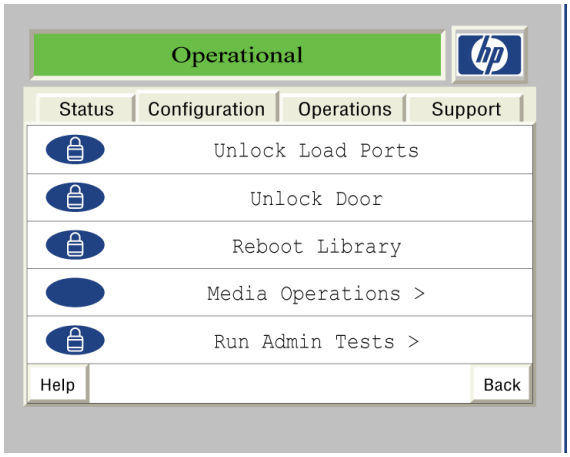


Table 6 Operations screen functions

Function	Description
Unlock Load Ports	Instructs the robot to unlock all load port doors. In library firmware version 1407 or later, this option can be protected using the admin password. (Password protection is enabled or disabled from the Configuration screen.) When all load port doors are closed, each load port is scanned and inventoried.
Unlock Door	Parks the robot, which enables you to open the center door of the library. The library is reinventoried after the center door is closed.
Reboot Library	Does a library reboot. Does an inventory of all tape slots and rediscovers all hardware controllers and tape drives.

Table 6 Operations screen functions *(continued)*

Function	Description
Media Operations	Performs the following tasks: • Move Tape Select a **Source** and **Element Type** (where you want to move a tape *from*) and a **Destination** and **Element Type** (where you want to move a tape *to*). Element types consist of a tape drive, load port (I/O), or slot location. Numbers can be entered from the keypad. The up/down arrows cycle you through full (source) or empty (destination) locations. After choosing a source and destination, select **Move**. • Clean Drive Select the cleaning media and the drive to be cleaned.
Run Admin Tests	Performs the following tests: • Operator Control Panel ◦ Align Touch Screen Touch and release the screen near the rectangle in the center. As you approach the rectangle at some point, it changes color. The color change takes place when the border of the rectangle is touched. This is where the touch pad and visual screen should be aligned. Use the **Up**/**Down**/**Left**/**Right** buttons to align the screen. There is no visual effect when using the adjustment buttons. Use the touch screen again to make sure that the adjustment is how you want it. Select the **Save** tab to make the adjustments permanent. ◦ Panel Colors —Displays the range of colors available to the OCP. ◦ Panel Pixel Test—Tests for bad screen pixels. Select the **Test** button to turn all pixels black. Touch the screen to turn all pixels white. Touch the screen again to end the test. ◦ Panel Firmware Version—Displays the version of the OCP firmware. ◦ Turn Backlight Off—When pressed, turns the OCP backlight off. • Inventory Library—Performs an inventory of all the tape cartridges in a library. Unlabeled tapes are shown as FULL if the library has been configured to detect unlabeled tapes. • Run Demo—Performs tape swaps between slots and load ports. Set the number of loops to be performed (must be at least one). When the demo completes, the tape cartridges are back in their original configuration. • Run Self Test—Initializes the mechanics and performs tests to make sure the library is functioning correctly. Tests include verifying the status of all components; tape exchanges between storage slots, load port slots, and tape drives; and corner-to-corner slot exchanges. When the self test completes, the tape cartridges are back in their original locations. • Slot Test—Performs a repeated move of a tape from one slot to another. Select the source slot, the destination slot, and the loop count, and then select Start Test. • Drive Load/Unload Test—Moves media into and out of each tape drive for a specified number of loops. • Force Rewind Unload Test—Clears the prevent media removal bit for a tape drive and unloads the tape cartridge to its original slot or to the first empty slot. Interrupts the tape drive operation that is currently running, if any. Use the Up and Down arrows to select the tape drive that you want to force rewind unload. • Recalibrate Library—Recalibrates all the targets in the library.

Support screen

The Support screen provides access to screens showing HP support information, service tasks, contact information, and enables you to display the library time.

Figure 35 OCP Support screen

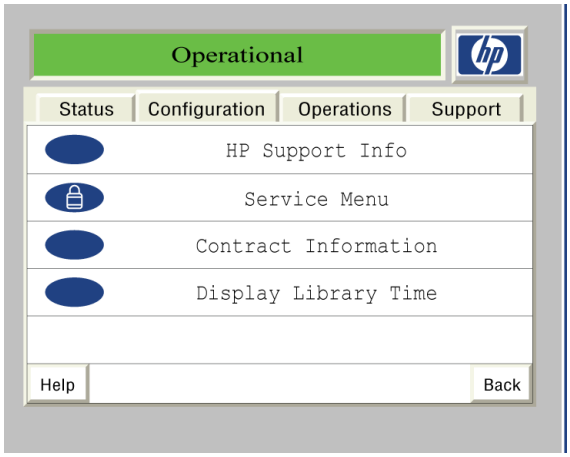


Table 7 Support screen functions

Function	Description
HP Support Info	Provides alternate locations where useful information can be obtained.
Service Menu	To be used only by authorized HP service personnel.
Contact Information	Provides contact information as recorded by Command View TL.
Display Library Time	This date and time are used for support purposes and do not necessarily reflect the local date and time.

Controls and indicators

Library robotics controller

Figure 36 Indicators on the library robotics controller

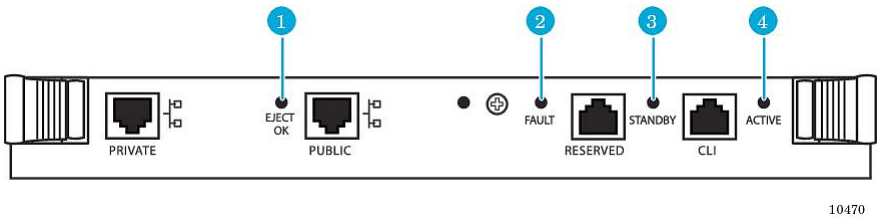


Table 8 Indicators on the library robotics controller

Index No.	Control/indicator	Function
1	EJECT OK LED	Not used.
2	FAULT LED	When flashing (red), indicates the card detects a board fault or software initialization in progress.
3	STANDBY LED	Not used.
4	ACTIVE LED	Always lit (green) when power applied.

Interface Manager card

Figure 37 Indicators and reset on the Interface Manager card 342213–001 or 393531–001

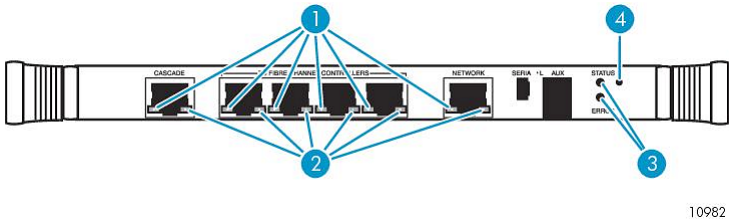


Figure 38 Indicators and reset on the Interface Manager card 480240-001

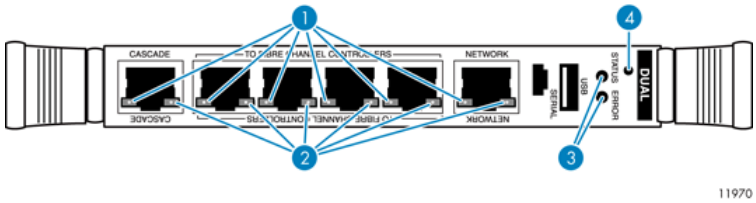


Table 9 Indicators and reset on the Interface Manager cards

Index No.	Control/indicator		Function
1	Green link speed LED		On—Port operating at 100 Mbps. Off–Port is operating at 10 Mbps, or port is not connected (see link activity LED).
2	Green link activity LED		Off–Port disconnected/no link. On–Port connected to another Ethernet device. Flashing–Data is being transmitted or received.
3	Red LED	Green LED	
	On	Off	BIOS code failed to run.
	Blinks 1x per 5 second interval	Off	Either: 1) Hardware POST failed; no firmware images are loaded. 2) There is no DHCP connection.
	Blinks 2x per 5 second interval	Off	No CompactFlash disk or valid boot sector image found.
	Blinks 3x per 5 second interval	Off	Specified firmware image files cannot be found. Neither the current nor the previous image was found.
	Blinks 4x per 5 second interval	Off	Load or execute command failed (boot code remains at end of process). This indicates that load, decompress, or execution failed on both the current and previous image files.
	Off	Blinks 1x per 5 second interval	Normal state. Load or execute command succeeded. Boot code successfully loaded, decompressed, and initiated one of the image files.
	Off	Blinks 2x per 5 second interval	Normal state. Application software is initializing.
	Off	Blinks 3x per 5 second interval	Normal state. Application is identifying all library components.
	Off	On	Normal state. Application has identified all library components.
4	Reset hole		To reset the card, insert a paper clip into the hole.

e2400-FC 2Gb interface controller

Figure 39 Indicators on the e2400-FC 2Gb interface controller

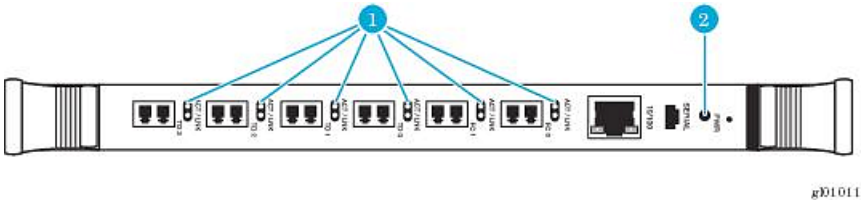


Table 10 Indicators on the e2400-FC 2Gb interface controller

Index No.	Control/indicator	Function
1	ACT/LNK indicators	ACT indicator–When lit, shows port activity. LNK indicatorWhen lit, shows a valid link is established.
2	PWR indicator	When green, power is applied to the module. When yellow, Power-On-Self-Test (POST) is in process or processor problems exist.

e2400-FC 4Gb interface controller

Figure 40 Indicators on the e2400-FC 4Gb interface controller

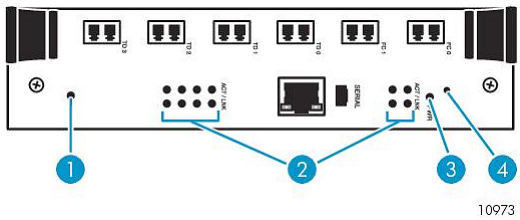


Table 11 Indicators on the e2400-FC 4Gb interface controller

Index No.	Control/Indicator	Function
1	Beacon	Use to locate the card.
2	ACT/LNK indicators	ACT indicator–When lit, shows port activity. LNK indicator–When lit, shows a valid link is established.
3	PWR indicator	When green, power is applied to the module. When yellow, Power-On-Self-Test (POST) is in process or processor problems exist.
4	Reset hole	To reset the card, insert a paper clip into the hole.

Figure 41 Indicator on an LTO2 or LTO3 tape drive

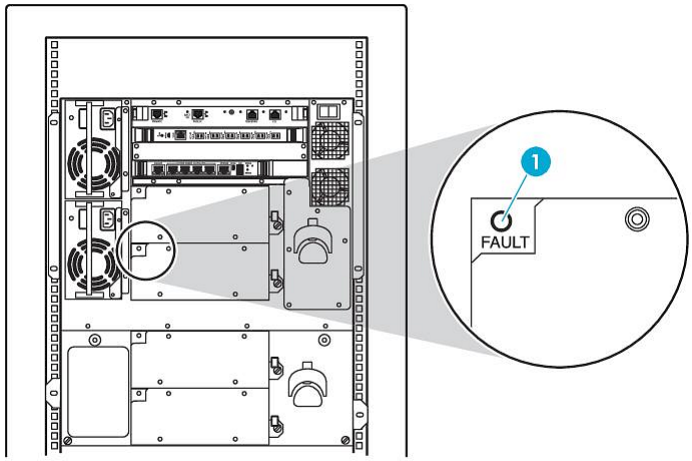


Table 12 Indicator on an LTO2 or LTO3 tape drive

Index No.	Control/indicator	Function
1	FAULT LED	When lit (yellow), indicates that initialization is in progress, the library robotics controller software has detected a failure that requires the replacement of the tape drive assembly, or a hot swap can occur. When not lit, indicates normal operation.

Figure 42 Indicators on an LTO4 tape drive

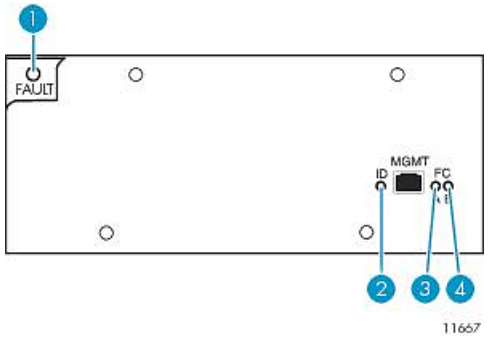


Table 13 Indicators on an LTO4 tape drive

Index No.	Control/indicator	Function
1	FAULT	When lit (yellow), indicates that initialization is in progress, the library robotics controller software has detected a failure that requires the replacement of the tape drive assembly, or a hot swap can occur. When not lit, indicates normal operation.
2	ID	Beacon.
3	FC A	When lit (green), indicates link activity on FC port A.
4	FC B	When lit (green), indicates link activity on FC port B.

Figure 43 Indicators on an LTO5 and LTO6 tape drive

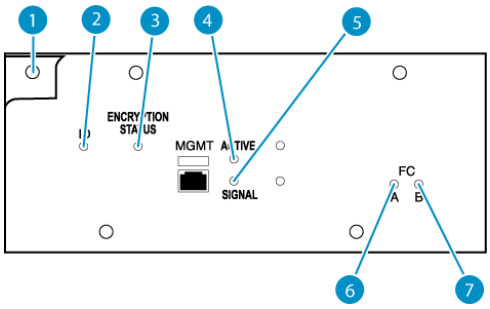


Table 14 Indicators on an LTO5 or later tape drive

Index No.	Control/indicator	Function
1	FAULT	When lit (yellow), indicates that initialization is in progress, the library robotics controller software has detected a failure that requires the replacement of the tape drive assembly, or a hot swap can occur. When not lit, indicates normal operation.
2	ID	Beacon.
3	ENCRYPTION STATUS	When flashing (green), indicates that the drive is reading or writing encrypted data.
4	MANAGEMENT ACTIVE	When flashing, indicates activity across the Ethernet port.
5	MANAGEMENT SIGNAL	When lit (orange), indicates the Ethernet port is connected.
6	FC A	When lit (green), indicates link activity on FC port A.
7	FC B	When lit (green), indicates link activity on FC port B.

Switch for the internal network

Figure 44 Indicators on the switch for the internal network

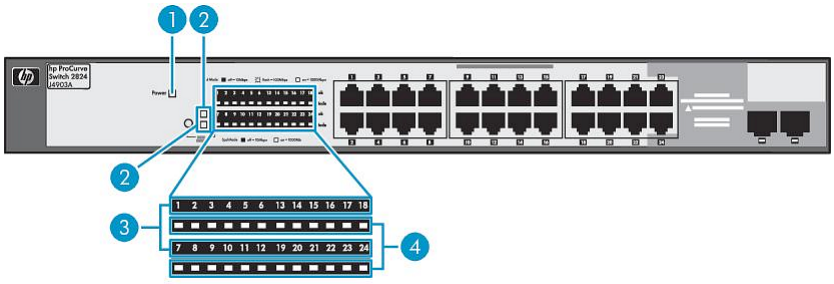


Table 15 Indicators on the switch for the internal network

Index No.	Control/indicator	Function
1	Power (green)	On--The switch is receiving power. Off--The switch is not receiving power.
2	LED Mode Select (2 green LEDs)	FDx--Indicates that the port Mode LEDs are displaying whether the ports are operating in full-duplex. Speed--Indicates that the port Mode LEDs are displaying the operating speed.

Table 15 Indicators on the switch for the internal network *(continued)*

Index No.	Control/indicator	Function
3	Link/Act	On--The port is enabled and receiving a link indication from the connected device. Off--The port has no active network cable connected, or is not receiving link signal. Flashing--Indicates that there is network activity on the port.
4	Mode	FDx--When the FDx (full duplex) indicator LED is on, the port Mode LEDs turn on for those ports that are operating at full duplex. Speed--When the Speed indicator LED is on, the port Mode LEDs for ports 1-22 are lit for ports that are in 100 Mbps mode and are off for ports operating at 10 Mbps. The port Mode LEDs for ports 23-24, are lit for ports that are in 100 or 1000 Mbps mode or are off for ports operating at 10 Mbps.

Library main power switch

Figure 45 Control on the library main power switch

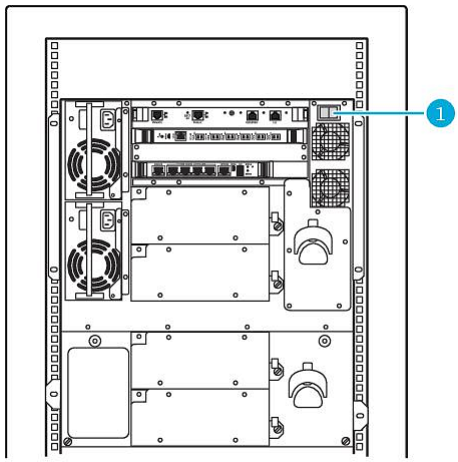


Table 16 Control on the library main power switch

Index No.	Control/indicator	Function
1	Switch	When switched On (**I**), powers on all library power supplies. When switched Off (**O**), places all library power supplies in standby mode.

Power supply in the base module or tape drive expansion module

Figure 46 Indicator on the autoranging power supply

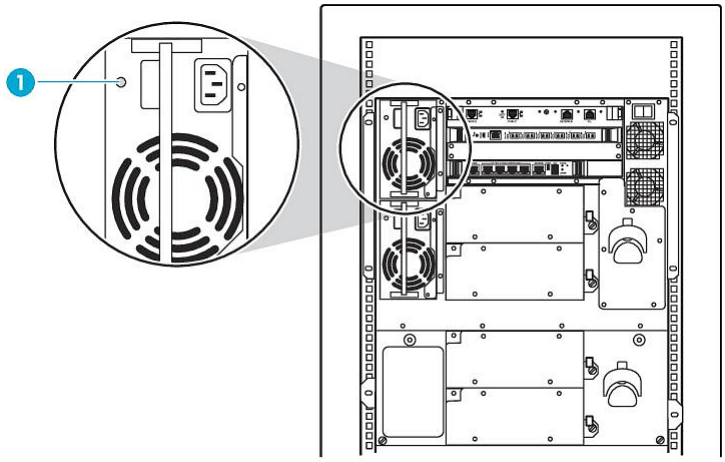


Table 17 Indicator on the autoranging power supply

Index No.	Indicator	Function
1	Power LED	When lit (green), indicates that all four DC outputs and the fan speed are within specification, and the AC boost circuit is active. When not lit, indicates the main library power switch is turned off or the power supply is in a failed condition and is available for a hot swap.

Power supply in the card cage expansion module

Figure 47 Indicators on the card cage expansion module power supply

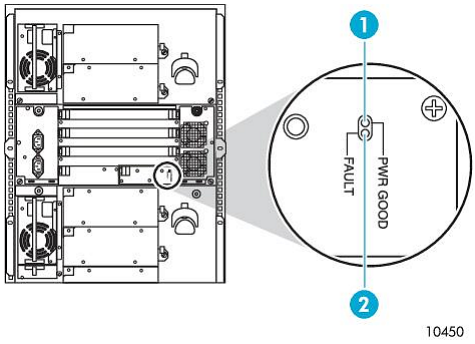


Table 18 Indicators on the card cage expansion module power supply

Index No.	Control/indicator	Function
1	PWR GOOD LED	When lit (green), all DC outputs and the AC input are within operational limits.
2	FAULT LED	When lit (yellow), one or all of the DC outputs or the AC input is not within operational limits. This can be an indication that the module power cord is not fully seated into a power receptacle at either end, or that the main library power switch is off.

Power distribution unit

NOTE: The EML 71e does not include a power distribution unit because you install it in your own rack.

Figure 48 Controls and indicator on the PDU

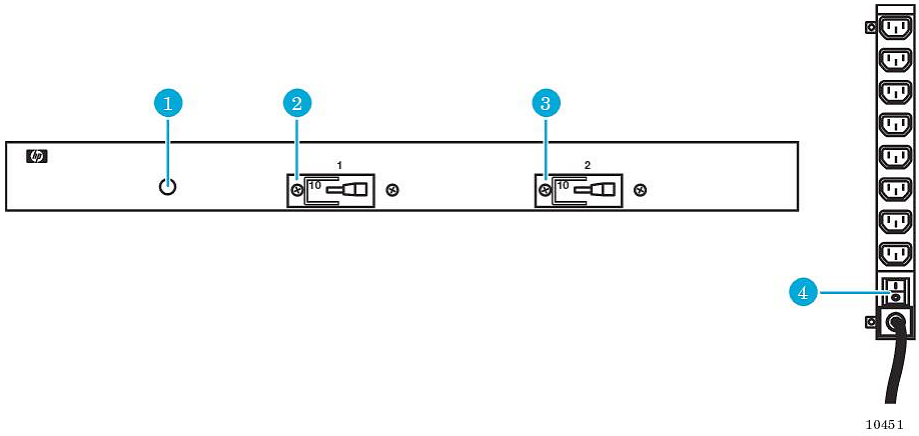


Table 19 Controls and indicator on the PDU

Index No.	Control/indicator	Function
1	Power LED	When lit (red), shows power is applied to the unit. When not lit, indicates the PDU is not receiving power.
2	PDU switch 1	When switched On, applies power to power strip 1.
3	PDU switch 2	When switched On, applies power to power strip 2.
4	Power strip power switch	When set to **I** (On), applies power to the power strip. When set to **O** (Off), removes power from the power strip.

3 Troubleshooting and event reporting

This chapter describes how to solve problems you might encounter while operating the library.

For additional assistance with troubleshooting, use the online HP Guided Troubleshooting tool which can be found at http://h20499.www2.hp.com/gts/sparks/public/Admin_Navigate_All_All_All.

Periodic and routine maintenance

This section describes maintenance that occurs on a scheduled or as-needed basis.

Maintaining tape cartridges

NOTE: In addition to the information provided in this manual, see the *HP Ultrium Tape Drive User Guide* from http://www.hp.com/support for more information.

For longer life of recorded or unrecorded tape cartridges:

- Do not carry tape cartridges loosely in a container that exposes them to unnecessary physical shock. Dropping or bumping tape cartridges can dislodge and damage internal components.
- Store tape cartridges vertically in their protective cases until needed. Store tape cartridges in a clean environment that duplicates the conditions of the room in which they will be used.
- Use tape cartridges in temperatures between 10°C and 40°C (50°F to 104°F).
- If a tape cartridge has been exposed to extreme heat or cold, stabilize the tape cartridge at room temperature for the same amount of time it was exposed for up to 24 hours.
- Keep tape cartridges out of direct sunlight, and do not place tape cartridges near electromagnetic interference sources, such as terminals, motors, and video or X-ray equipment. Performing so can cause data on the tape cartridge to be altered or erased.
- Do not touch the tape medium or open the tape door unnecessarily. Dust and skin oils can contaminate the tape, impact performance, and cause damage.
- Store tape cartridges in a dust-free environment where the relative humidity is between 20 percent and 80 percent. For longer tape cartridge life, store the tape cartridge at 40 percent to 60 percent relative humidity.
- Use only HP qualified barcode labels. Apply them only in the designated areas of the tape cartridge, and do not apply more than one per tape cartridge.
- Follow guidelines provided by the tape cartridge manufacturer.

△ **CAUTION:** Do not touch the tape leader or the tape medium. Dust or skin oils can contaminate the tape performance, and cause damage.

Cleaning Ultrium tape drives

Be aware of the following:

- Ultrium tape drives have been developed to have a minimal cleaning requirement.
- An Ultrium universal cleaning cartridge can be used up to 50 times. If you are using an older Ultrium cleaning cartridge, check the documentation that came with your cleaning cartridge.

△ **CAUTION:** Only use Ultrium universal cleaning cartridges in Ultrium tape drives. See "Ordering HP tape cartridges and barcode label packs" (page 102) for obtaining supplies. The same cleaning cartridge is used for all Ultrium tape drives.

- If the cleaning cartridge is ejected immediately, is expired, or is not an Ultrium cleaning cartridge, discard it and use a new one.

To clean the tape heads:

1. Move a cleaning cartridge into the tape drive using your application software. The tape drive automatically loads the cleaning cartridge and cleans the heads. The cleaning cycle can take up to five minutes.
2. Move the cleaning cartridge back to the proper storage bin using your application software.

Diagnostic support tools

The following tools are available to help you troubleshoot the library:

- Command View TL
- Library and Tape Tools

Command View TL version 1.5.5 or later provides SAN-related diagnostics for the major library components such as interface controllers, tape drives, and robot. Only Command View TL can generate support tickets for the interface controllers, the Interface Manager card, and the management station. You should do all library firmware updates with Command View TL. To use the Command View TL for library diagnostics, see the *HP Interface Manager and Command View TL User Guide*.

Library and Tape Tools (L&TT) is installed on the host, which enables you to troubleshoot host connectivity and performance. In addition, with L&TT you can:

- Identify all FC devices connected to your system.
- View detailed configuration, identification, inventory, and tape drive information for the library.
- Run advanced diagnostic tests, including connectivity, read/write, media validation, and testing library functionality.
- View library and tape drive error logs.
- Generate a detailed support file that can be E-mailed or faxed to your support representative for analysis.

The L&TT diagnostic provides an intuitive GUI with integrated context-sensitive help, and can be downloaded free of charge. Go to http://www.hp.com/support/tapetools and select **HP L&TT Tool**.

Troubleshooting

An incorrect installation or configuration can cause platform problems. In this case, the library appears to be operating normally, but no data can be interchanged, or performance is poor. You also could get an error code on the OCP. To identify an error caused by this type of problem, check your installation and configuration setup.

General tape drive errors usually result from a miscommunication between a library processor and a tape drive processor, tape drive and tape interaction issues, or a mechanical malfunction within

the library. Both platform problems and general tape drive errors display an error message or event code on the OCP. Use the event codes listed later in this chapter to help determine a recovery procedure.

The library depends on several other components to operate correctly. Errors that seem to be caused by the library are often a result of issues on the host, the network cabling, or with the application software. When troubleshooting the library, begin by ruling out these components.

Your application software may need to be reconfigured or, in some cases, reinstalled after you have installed additional tape drives or slots into the library. Changing the number of load ports, number of reserved slots, or type of tape drive, might require changes to software. Some application software may require the purchase of additional add-on components or licenses when increasing the number of storage slots or tape drives. Contact your application software provider for more information, or if your application software does not recognize newly installed storage slots or tape drives.

Command View TL should be the first tool used to diagnose a problem, followed by L&TT. These two applications generally provide more detail than the OCP, but the OCP can be an aid in determining the cause of errors. Support tickets from Command View TL or L&TT contain full log events for all components. The OCP only shows summary information for robotic events. A support ticket has to be generated to access the event logs.

Using the OCP, you can check the event log on the Status screen for the five most recent informational, warning, or critical events. The last event listed on the screen is the most recent event that occurred. Events have a date stamp, code numbers, a brief text description of the problem, and usually a location of the module or slot where the error took place. The following is an example of an OCP log event, and what information is included:

```
2005-04-06T10:07:57.068, 0.0.0.0.0, 3200, ifm, (null), error, 3000,
3312, "(re . . "
```

Code values are decoded with a support ticket from Command View TL and L&TT. This OCP message decodes to:

Date/time, address, opstate, source, source, severity, activity, event ID or result, additional information.

In this case, the opstate is *Ifm is ok*, the activity is *Cartridge Move* and result is *Get Failed*.

For general troubleshooting, use the following table after you isolate your problem to a category or specific area of the library, and then go to the reference mentioned that describes a corrective action.

Table 20 Fault isolation to a specific area

Problem area or category	Where to find corrective action
Startup problems	Go to (page 53)
OCP problems	Go to (page 55)
Robotics problems	Go to (page 55)
Operating problems	Go to (page 57)
Tape drive problems	Go to (page 57)
Interface Manager card problems	Go to (page 59) and (page 60)
Interface controller problems	Go to (page 61)

Startup problems

Table 21 Startup problems

Problem	Corrective action
The library does not power on.	Make sure that: • The power cord is connected to a grounded electrical outlet. • Each PDU power switch is on, as well as the switch on the power strips.

Table 21 Startup problems *(continued)*

Problem	Corrective action
	• Power cords from PDU power strips are installed and seated. • The library main power switch is on.
The library powers on but the robot does not move.	• Check the connections of the Ethernet cable between the library robotics controller and the Interface Manager card. • If the Interface Manager card does not have access to the DHCP server and the library firmware is at release 2.4 or greater, access the CLI from a serial connection and execute the command `set network config eml`. • If the Interface Manager card does not have access to the DHCP server and the library firmware is at an earlier version than 2.4, use a valid service password to enter the IM CLI service mode then use the `set network config eml` command. • Make sure that the robot shipping restraints have been removed.
The library or tape drives are not detected by the Interface Manager card or Command View TL software.	• Check cable connections. • Check the cabling. Make sure that all radial bends are greater than 5 cm (2 inches) in diameter. • Make sure that the tape drives and library are powered on and can be seen by the OCP and hosts. • Check that the FAULT LED on the tape drives are off. • Check the log files for network problems. • Make sure that the interface controllers are powered on and ready.
During initialization, the library robot stops moving and the OCP status bar is red.	• Use Command View TL or L&TT to generate a support ticket and check the event log. • Check the last entry in the critical error log on the OCP. Use the following errors as examples in correcting the problem: **0100: Module # does not have RLP(2)** • Check power to the module number. Refer to the checks listed previously under “The library does not power on.” **5501: Failed target calibration for MRC: X, X, X** • Make sure that nothing is obstructing the barcode reader. • Make sure that the magazine is installed and seated properly. • Check for defective magazine target markings. **0000: End of Text** • Open the library door and check the picker for a tape cartridge. If a cartridge is present, remove the tape cartridge and place it into an empty slot. Close the library door to start an inventory. **Opcode: 0514 (Robot needs to be reset)** • The library can fail to initialize if a tape is located on the floor. If unable to use Command View TL or Telnet, disconnect the network connection and reconnect.
One or more tape drives fail during startup.	• Check power supply indicator for power to the tape drive. • Check that the tape drive is properly cabled and ready. • Check the link indicators on the interface controllers for a valid link to the tape drives. • Check whether the FAULT indicator is lit on the back of the tape drive. If so, diagnose the problem. • Make sure the tape drive has the appropriate firmware.

Table 21 Startup problems *(continued)*

Problem	Corrective action
The OCP displays a yellow warning and the **Status→Health Summary→Interface Manager** screen indicates the Interface Manager card is initializing.	• Check cable connections. • Check Interface Manager card and interface controller configurations. If problem persists: • Reset the interface controller. • Power cycle the library. • Reset the default configuration on the interface controller.

OCP problems

Table 22 OCP problems

Problem	Corrective action
The OCP is blank.	• Touch the OCP to wake it from sleep mode. • Confirm that the power is on. • Use Command View TL software or the Interface Manager CLI to check for errors. See the *HP Interface Manager and Command View TL User Guide*.
The OCP does not respond to touch.	• Make sure that the Ethernet cable is properly connected between the library robotics controller PUBLIC port and the CASCADE port on the Interface Manager card. • Use Command View TL or the Interface Manager CLI to check for errors.
An error message appears on a red OCP status bar.	• Review latest error messages in the critical and warning event logs to help decipher the message and determine the cause.
A warning message is appears on a yellow OCP status bar.	• Check the Health Status on the OCP to determine cause. • Review latest event details in the warning event log to determine the cause.

Robotics problems

Table 23 Robotics problems

Problem	Corrective action
The robot does not move at power on.	• Make sure that all internal shipping restraints have been removed. • Check that the library center door is closed. • Review latest error messages in the critical and warning event logs to help decipher the message and determine the cause.
The picker partially grips a tape cartridge.	• On the OCP, enter the **Operations→Media Operations→Move Tape** command to move the tape cartridge from the picker to an empty slot. • Review latest error messages in the critical and warning event logs to help decipher the message and determine the cause. • Power cycle the library.
The barcode reader fails.	Use the OCP to open the center door and: • Make sure that nothing obstructs the reader. • Make sure that nothing is obstructing the robot. • Make sure that all tape cartridges are fully inserted into the storage slots and no tapes are lying on the library floor. • If barcode labels are required, check that approved labels are being used and are correctly applied.

Table 23 Robotics problems *(continued)*

Problem	Corrective action
	Close the center door to recalibrate the library.
The robot times out or hangs.	• Make sure that nothing obstructs the robot. • Retry the operation. • Power cycle the library to recalibrate. • Review latest error messages in the critical and warning event logs to help decipher the message and determine the cause.
The robot fails during an operation.	Review latest error messages in the critical and warning event logs to help decipher the message and determine the cause.
The robot drops a tape cartridge.	• Use the OCP to open the center door. Retrieve the tape cartridge, position it properly, and place the tape cartridge in an empty storage bin. (Do not try to place the tape cartridge in the picker.) • Close the doors to perform an inventory.

Operating problems

Table 24 Operating problems

Problem	Corrective action
The host computer cannot communicate with the library.	• Make sure that Command View TL reports a green status for the library and tape drives. • Make sure that the host computer was added to the Secure Manager using the Command View TL software, and was given access to library components. • Check library network configuration. • Make sure that there is power to library components. • Make sure that cable connections and termination are correct. • Check that the interface controller is configured correctly for the SAN it is attached to (for example, fabric or loop). • Make sure that the interface controller link LEDs show activity. • Restart the host and the library.
A tape cartridge (medium) is reported not present.	• Make sure that the designated tape cartridge is present and properly seated. (For a tape drive, make sure that the tape cartridge is completely unloaded.) Then, retry the command. • Make sure that the tape cartridge has good barcode labels, or that the library is configured to not use labels. • On the OCP, make sure **Support→Service Menu+autoaudit** is turned On. If autoaudit is Off, the library does not do an inventory and therefore might report storage slots with tape cartridges as being empty. • Perform an inventory by opening and closing the center door.
A move command failed.	• Review event logs for detailed information. • Check the source and destination. The source should hold the tape cartridge to be moved; the destination should be empty. • Make sure that the picker is empty and that there are no obstructions. • Retry the command.
Long inventory times.	Use barcoded media and configure the library to use barcodes. Expect inventory times ranging from 30 minutes for a 24U library to 1 hour for a 40U library with unlabeled media.
Redundant power supply warning.	A warning indicates that the redundant power supply failed. Make sure that there is AC power to the power supply. If it is receiving power, replace the power supply.

Tape drive problems

IMPORTANT: For LTO4 or later tape drives, you must use FC port A to connect the tape drive to the SAN unless you are using ETLA custom mapping in which case either port A or B can be used.

Table 25 Tape drive problems

Problem	Corrective action
The library is unable to communicate with a tape drive.	This is indicated by a Drive Communication Time-out error. • Tape drives added to new drive bays require a reboot. • Check link indicators on the interface controllers (LTO2 and LTO3 tape drives) or on the switch for the internal network (LTO4 and later tape drives).

Table 25 Tape drive problems *(continued)*

Problem	Corrective action
	• Reseat the tape drive. • Check tape drive status on the OCP and with Command View TL.
The tape drive does not eject a cartridge.	• Attempt the operation from the application software. • Open the center door, reach in, and then press the Eject button on the tape drive in question. If this fails, press and hold the Eject button for at least ten seconds to force an eject. • Power off the library, disconnect the FC cables, power on the library, open the center door, and press and hold the Eject button on the tape drive in question.
The tape drive reports a read/write error.	• Try using a new tape. • Clean the tape drive. • Run the tape drive assessment test using L&TT.
An LTO4 or later tape drive does not link up	Some switch types require specific speed and topology settings. Try changing the speed and topology settings with Command View TL or the Interface Manager CLI. • LTO4 and later tape drives have a default speed setting of auto negotiate. Change the speed to 1Gb (LTO4 only), 2Gb, 4Gb, or 8Gb (LTO5 and LTO6). • LTO4 and later tape drives have a default auto negotiate topology setting of loop-ptp which will try loop mode first, and then switch to point-to-point if loop is not successful. Change the topology or mode setting to soft or hard loop mode, or N_port mode which uses only point-to-point topology. **NOTE:** Restoring the Interface Manager defaults with Command View TL or the Interface Manager CLI will set the drive speed and topology back to the auto negotiate settings.

Interface Manager card problems

In addition to the Command View TL GUI, the Interface Manager card can be managed through a CLI. These CLI commands can be used to diagnose problems. You can access the CLI either through a direct RS-232 serial connection or by using Telnet over the LAN. Refer to the *HP Interface Manager and Command View TL User Guide* for instructions on using the CLI.

The following table describes common symptoms relating to the Interface Manager card and how to resolve them. (page 60) provides more Interface Manager card fault isolation procedures through the actions of LED indicators.

Table 26 Common Interface Manager card issues

Symptom	Possible cause	Solution
Command View TL server does not detect the Interface Manager card.	Bad network connection	• Make sure that the Interface Manager card and the management station are correctly connected to the LAN. • Use LEDs to troubleshoot Ethernet cabling ((page 43) and (page 60)). • Ping the Interface Manager card to make sure that the network is healthy.
	Interface Manager card not powered on or in ready state	• Power on the library. Observe status and link LEDs ((page 43) and (page 60)). • Check for proper version of firmware. See the *HP Interface Manager and Command View TL User Guide* for instructions.
Command View TL server does not detect the Interface Manager card (cont.).	Incorrect IPv4 address or IPv6 Interface Identifier	Make sure the correct IPv4 or IPv6 address of the Interface Manager card is entered in Command View TL. • See the *HP Interface Manager and Command View TL User Guide* for information on using CLI commands to make sure that the network IP address is correct. • Configure Command View TL with the correct IP address. See the *HP Interface Manager and Command View TL User Guide* for information on adding a library or visit http://www.hp.com/support/cvtl. • See the *HP Interface Manager and Command View TL User Guide* for information about adding the library to Command View TL.
Interface Manager card does not detect one or more interface controllers.	Bad network connection	• Make sure that the Interface Manager card is properly connected to the interface controllers and that the cables are good. • Use LEDs to troubleshoot Ethernet cabling ((page 43) and (page 60)).
	Defective Interface Manager card or interface controller	• Observe status and link LEDs ((page 43)). Replace defective card or controller.
Interface Manager card does not detect tape drives or library.	Timing issues	Reset the corresponding interface controller.
	Tape drive not powered on or in ready state	• Make sure the tape drive is not powered off. • Troubleshoot the tape drive.
Interface Manager card unresponsive, with link activity light stuck on or off.	Possible ESD failure	Reboot the library.
Message on OCP **Status→Health Summary→Interface Manager** screen shows warning that Interface Manager card is initializing.	Improper settings	Restore system defaults using CLI.
Topology incomplete (Interface Manager card timed out when attempting communication with interface controllers).	System interference	Retry the command. This behavior can be expected if system activity is high, because the Interface Manager commands have lower priority.

Table 26 Common Interface Manager card issues *(continued)*

Symptom	Possible cause	Solution
	Cabling	Check cabling and observe indicators on the Interface Manager card, interface controllers, and tape drives.
	Configuration	• Check each interface controller for active link LEDs to each tape drive. • Check that the number of tape drives reported by the library matches the number of tape drives reported by the Interface Manager card. Check each interface controller for correct number of tape drives mapped. Reboot mismatched interface controllers or tape drives, if needed. Restore default configuration on mismatched interface controllers and reboot. • Disconnect Interface Manager card from interface controllers and restore system defaults on the Interface Manager card. Reconnect connections to interface controllers and reboot. • Swap tape drive locations to see if the problem follows the tape drive, and replace the tape drive, if needed.
Command View TL does not run in the browser.	Incompatible browser version or Java™ support not enabled	• Make sure that you are using a minimum of Microsoft Internet Explorer 6.0 SP1 or later, or Netscape Navigator 6.2 or later. • Make sure that Java support is enabled in the browser.
	Java Runtime Environment (JRE) not installed	Download and install the Java 2 Platform, Standard Edition 1.4.2 or later from http://wwws.java.com.
	Bad network connection or network down	• Check all physical network connections. If the connections are good, contact your network administrator. • Ping the management station. If pinging fails and the IP address is correct, contact your network administrator.
	Wrong IP address	• Check the IP address of the management station. On the management station, open a command shell and enter IPCONFIG. You must use this IP address (or the network name of the management station) in the URL to access Command View TL.
	Management station not running, or Command View TL service not running on management station	• Check to see if the management station is operational. • Use the Services applet to make sure that the Command View TL service is running on the management station. Select **Start→Settings→Control Panel→Administrative Tools→Services**.

Table 27 Interface Manager card LED fault isolation

Indicators		Procedures
Red LED	**Green LED**	
Blinks 1x per 5 second interval	Off	Reset the Interface Manager card (see (page 43)). If the problem persists, replace the Interface Manager card.
Blinks 2x per 5 second interval	Off	
Blinks 3x per 5 second interval	Off	

Table 27 Interface Manager card LED fault isolation *(continued)*

Indicators		Procedures
Blinks 4x per 5 second interval	Off	
Off	Blinks 1x per 5 second interval	• Reset the Interface Manager card (see (page 43)). • If the Interface Manager card does not have access to the DHCP server and the library firmware is at release 2.4 or greater, access the CLI from a serial connection and execute the command `set network config eml`. • If the Interface Manager card does not have access to the DHCP server and the library firmware is at an earlier version than 2.4, use a valid service password to enter the IM CLI service mode then use the `set network config eml` command. • If the problem persists, replace the Interface Manager card.
Off	Blinks 2x per 5 second interval	Interface Manager card is in discovery mode. If problem persists, it can be due to an incomplete topology. Refer to (page 59).
Off	Blinks 3x per 5 second interval	Processes are running. If the problem persists, check the configuration and the IP address.

Interface controller problems

Most problems with the interface controller occur during the initial installation. Before proceeding with advanced troubleshooting techniques, make sure that all connections are correct and review the configuration and firmware. If a new interface controller was installed, the library may need to be rebooted for the controller configuration to be set.

LED indicators

The LED indicators on the interface controllers (see (page 44) and (page 44)) are useful for diagnosing various problems:

- FC port LEDs--Indicate FC activity (ACT) and link (LNK) status. If the link LED is not lit, it can indicate a problem with an FC link. Make sure that the FC port configuration and cabling is correct.
- Ethernet LEDs--Indicate activity and link status. If one of these indicators is not lit or stays continuously lit, it can indicate a problem with the network connection or cabling. Make sure that the network connection is correct. The port must be connected to a 10/100Base-T Ethernet network to function properly.

Basic troubleshooting

Simplify the installation by reducing it to the most basic configuration. Then, add elements one at a time, making sure that the library operates correctly after each step.

Basic troubleshooting includes making sure that the setup and connections are correct:

- The FC port connection
- The interface controller configuration
- Devices
- Host configuration
- HBA device driver information
- Serial port configuration

Each of these topics is discussed in the following sections.

Examining FC port connection

Most hubs and switches have link indicators showing link status. When the interface controller is connected and powered on, the link indicator appears solid. If it is not, examine the cabling or connections.

To examine links:

- Make sure that the library is not running any tasks before disconnecting any cables. Disconnect and reconnect the FC cable. This procedure causes momentary activity of this indicator as the link reinitializes.
- Make sure that the cable type for the interface controller and the attached hub, HBA, or switch are similar.

NOTE: By default, the FC port speed is set to 2 Gbps for the e2400-FC 2Gb interface controller and to 4 Gbps for the e2400-FC 4Gb interface controller. Changes to the FC port speed must be manually set, such as for 1 Gbps. If set incorrectly and the interface controller is plugged into a Loop or Fabric, the unit can receive framing errors, which can be found in the trace logs; the fiber link light will be off because of the incorrect FC link speed.

Examining the interface controller configuration

To examine the interface controller configuration, make sure that:

- The interface controller speed is set correctly.
- The connection type is set correctly.
- The host is added to Secure Manager in Command View TL and given permission to communicate with the library.

Examining devices

HP recommends using Command View TL to make sure that the devices are operating correctly.

Examining the host configuration

In some cases, the FC HBA or host device driver may not be working properly. Check the configuration of these elements.

Check the release notes for the device driver to see if there are any specific issues or a required configuration. Also, make sure that you are using the current version of the HBA driver.

Older applications can have expectations about what constitutes a valid SCSI ID, and thus may not correctly handle certain mappings. This is not an issue for the operating system or most applications. However, some applications may exhibit difficulties addressing target IDs greater than 15 (16 and higher). To resolve this situation in a direct-attach configuration, configure the interface controller to use hard addressing and set the AL_PA to a value that the HBA can map, with an ID less than 16.

Examining HBA device driver information

Review the HBA device driver `Readme.txt` file for configuration specifics. An HBA may require a different configuration. HBAs typically come with utility programs to view or change their configurations.

Examining serial port configuration

If you have problems connecting to the serial interface, make sure that the configuration of the terminal or terminal emulation program is correct.

Table 28 Terminal configuration settings

Attribute	Setting
BAUD Rate	Autobaud, 9600, 19200, 38400, 57600, *115200*[1]
Data Bits	8
Stop Bit	1
Parity	None
Flow Control	None or XON/XOFF

[1] Default setting

If problems persist, examine the cabling.

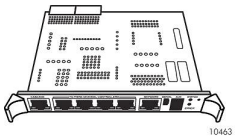
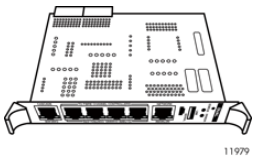
If a valid Ethernet IP address is configured, serial configuration settings can also be set using Telnet.

4 Removing and replacing parts

This chapter provides information for the removal and replacement of each expansion module and field replaceable unit (FRU).

CAUTION: Components within the library contain static-sensitive parts. Use appropriate ESD precautions, including the use of a grounding strap, when performing service inside the library.

Interface Manager card

Part Number	342213-001, 393531-001 or 480240-001
Location	Bottom slot in the base-module card cage
Characteristics	Contains six Ethernet connections to the library robotics controller, four interface controllers, and the SAN; two 3-pin serial ports; status, activity, and error LEDs
Function	Manages the interface controllers in order to monitor and manage the library
Illustration	 342213-001 or 393531-001  480240-001

Required tools

- #1 Phillips screwdriver

Interface Manager card 342213-001 or 393531-001

This section explains how to replace the 342213-001 or 393531-001 Interface Manager card installed in an EML E-Series tape library. These versions of the Interface Manager card contain a label with the part number AS#340252-001 or AS#340252-002 and have an AUX port next to the serial port.

Removing the Interface Manager card 342213-001 or 393531-001

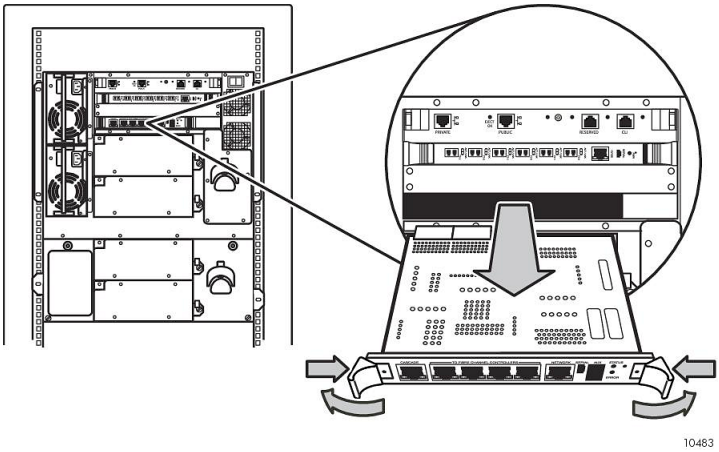
1. Use your backup software to stop all library activity and make sure the picker is empty.
2. Turn off the power to the library.
3. Identify the Interface Manager card. It is located in the bottom slot in the card cage in the base module.
4. Label the cables or write a note that shows the locations of all the cables plugged into the Interface Manager card to make it easier to reconnect them later.
5. Unplug all cables from the Interface Manager card.

6. Loosen the captive screws in the ejector handles at both ends of the Interface Manager card. Use a #1 Phillips screwdriver.

CAUTION: Be aware that the metal tabs on the gasket on the filler panel can be caught and bent by the pins on the Interface Manager card. If bent, these tabs can cause a short circuit. Avoid removing or installing the Interface Manager card at an extreme angle and watch that the metal tabs on the gasket do not get caught or bent.

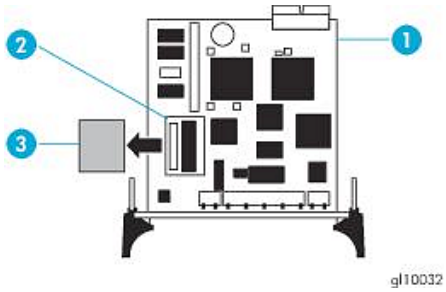
7. Push the ejector handles to the outside, and then pull the ejector handles to remove the Interface Manager card from the library.
8. Pull the ejector handles to remove the Interface Manager card from the library.

Figure 49 Removing the Interface Manager card



9. Move the CompactFlash memory card from the original Interface Manager card to the new Interface Manager card. The CompactFlash memory card stores the firmware and configuration information for the Interface Manager card.
   a. Put the Interface Manager card battery-side up on your work surface.
   b. Grasp the edges of the CompactFlash memory card and slide it out of the flash memory slot. If needed, push a pen into the corner notches of the flash memory slot to disengage the CompactFlash memory card.

Figure 50 Removing the CompactFlash memory card from the Interface Manager card

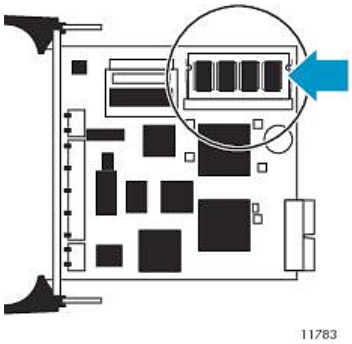


1. Interface Manager card
2. Flash memory slot
3. CompactFlash memory card

   c. Put the new Interface Manager card battery-side up on your work surface.
   d. With the connector going in first, align the sides of the CompactFlash memory card with the flash memory slot on the new Interface Manager card. Gently slide the CompactFlash memory card into the slot until it is fully engaged. If the CompactFlash memory card does not slide in easily, the card is upside down.

10. Compare the memory modules.
    a. Locate the memory module on the old and replacement Interface Manager cards. Compare the memory modules on the two cards.
        - If the memory module on the old Interface Manager card has more memory, follow the instructions in Step 10.b to put the larger memory module on the new Interface Manager card.
        - If the memory modules on the two Interface Manager cards have the same amount of memory or the new Interface Manager card has more memory, skip Step 10.b and continue with "Replacing the Interface Manager card 342213-001 or 393531-001" (page 66).

Figure 51 Comparing memory modules



    b. Remove the memory module from both Interface Manager cards. To remove the memory module from the Interface Manager card, pull the latches away from the memory module on both sides. When both latches are unfastened, the memory module pops up.

       Grasp the edge of the memory module and pull it out of the socket.

       Insert the memory module with the most memory into the memory module socket on the replacement Interface Manager card. Push down on the module to fasten the latches.

       Insert the other memory module into the memory module socket on the old Interface Manager card. Push down on the module to fasten the latches.

Replacing the Interface Manager card 342213-001 or 393531-001

1. Position the Interface Manager card as shown in (page 65). Align the Interface Manager card with the guides in the bottom slot in the card cage in the base module and slide the Interface Manager card into the library.
2. Push the ejector handles to the inside to fully engage the Interface Manager card into the backplane.
3. Tighten the captive screws in both ejector handles. Use a #1 Phillips screwdriver.
4. Plug the cables into the Interface Manager card exactly as they were plugged into the original Interface Manager card (see the labels on the cables or the note that you wrote).
5. Turn on the power to the library.

NOTE: Because all of the configuration settings for the Interface Manager card are stored on the CompactFlash memory card that you moved, your new Interface Manager card retains the configuration of the original card. To examine or change these settings, see the *HP Interface Manager and Command View TL User Guide*.

6. Make sure that the status LEDs indicate a normal state (see (page 43)).

Interface Manager card 480240-001

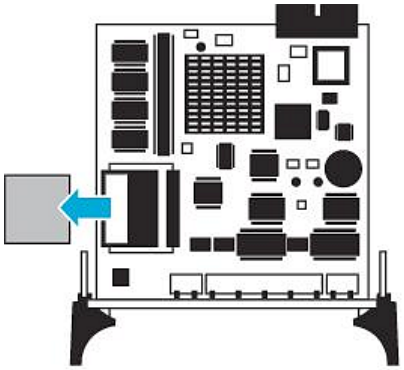
This section explains how to replace the 480240-001 Interface Manager card installed in an EML E-Series tape library. This version of the Interface Manager card contains a label with the part number AS#340252-003, has a USB port next to the serial port, and has the word DUAL printed on the bezel.

Removing the Interface Manager card480240-001

1. Verify that your library meets the following requirements:
   - This board requires a 1 GB CompactFlash to operate; you cannot use a CompactFlash with a different capacity. Therefore, the Interface Manager card that you are replacing must contain a 1 GB CompactFlash. (In Step 7, you move the CompactFlash from the original card to the new card.) If you need to order a 1 GB CompactFlash, contact HP service.
   - You cannot use the 480240-001 Interface Manager card in the ESL9000 tape library. If you have an ESL9000 library, use either the 342213-001 or 393531-001 Interface Manager card instead.
   - The 480240-001 Interface Manager card requires firmware version I231 or later to operate. Do not downgrade the firmware to an earlier version.
2. Use your backup software to stop all library activity and make sure the picker is empty.
3. Turn off the power to the library.
4. Identify the Interface Manager card. It is located in the bottom slot of the base module card cage.
5. Label and unplug the cables.
   a. Label the cables or write a note that shows the locations of all the cables plugged into the Interface Manager card to make it easier to reconnect them later.
   b. Unplug all cables from the Interface Manager card.
6. Remove the Interface Manager card.
   a. Use a #1 Phillips screwdriver to loosen the captive screws in the black ejector handles at the ends of the Interface Manager card.
   b. Push the ejector handles to the outside, then pull on them to remove the controller.

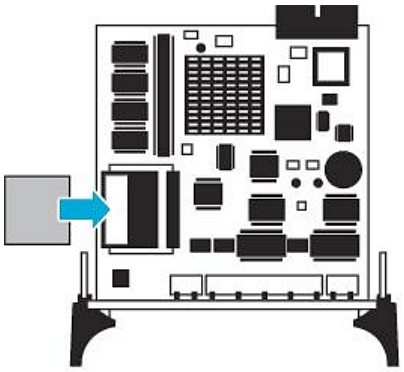
△ **CAUTION:** Be aware that the metal tabs on the gasket on the filler panel can be caught and bent by the pins on the Interface Manager card. If bent, these tabs can cause a short circuit. Avoid removing or installing the Interface Manager card at an angle and watch that the metal tabs on the gasket do not get caught or bent.

7. Move the CompactFlash card.
   a. The Interface Manager card contains a CompactFlash card which stores the library configuration. To retain the library configuration, move the CompactFlash card to the replacement Interface Management card.



10032a

   b. Grasp the edges of the CompactFlash card and slide it out of the slot on the original Interface Manager card. If needed, push a pen into the corner notches of the slot to unseat the CompactFlash card.
   c. Remove the replacement Interface Manager card from its protective sleeve and place it on your work surface.



10033a

   d. With the connector going in first, align the sides of the CompactFlash card with the slot on the replacement Interface Manager card. Gently slide the CompactFlash card into the slot until it is securely seated.

NOTE:

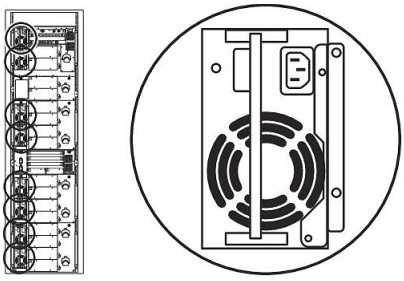
If the CompactFlash card does not slide in easily, it is upside down. Pull the card back out, flip it over, and reinsert it into the slot.

Replacing the Interface Manager card 480240-001

1. Reinstall the Interface Manager card.
   a. Align the Interface Manager with the guides in the base module card cage and slide the Interface Manager into the library.
   b. Push the ejection handles to the inside to fully seat the card. Tighten the captive screws.
2. Plug the cables into the new Interface Manager card exactly as they were plugged into the original card.

3. Power on the library.
   a. Set the library power switch at the upper right corner to the ON position. Check the power supply power indicators to verify that the power is on.
   b. Verify that the library robotics controller Active indicator is lit. The library will take 20 minutes or more to boot, depending on the configuration.
4. Verify that the status LEDs of the Interface Manager card indicate a normal state. The red LED should be off and the green LED should be blinking or solid.
5. Close the back doors of the library.
6. Verify the library configuration. Because all of the configuration settings of the Interface Manager card are stored in the CompactFlash card that you moved, the replacement Interface Manager card retains the configuration of the original card. To verify or change these settings, refer to the *HP Interface Manager and Command View TL User Guide*.

Power supply in the base module or tape drive expansion module

Part number	375815-001 or 409857–001
Location	Left side of the base module or tape drive expansion module
Characteristics	• Hot-swappable • Input rating: 100–240 VAC, 50-60 Hz, 7.2A • Output rating: +3.3 VDC, +5 VDC, +12 VDC, -12 VDC • 360 Watts total output power
Function	Provides power to the base module or tape drive expansion module components
Illustration	

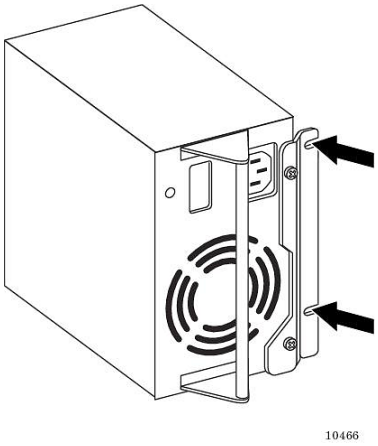
Required tools

- T-15 Torx screwdriver

Removing a power supply from the base module or tape drive expansion module

1. Identify the power supply to be replaced. The power LED might be off (see (page 48)).
2. Do one of the following:
   - If the faulty power supply is redundant, the library does not have to be powered off during this procedure.
   - If the faulty power supply is the only power supply in the base module, stop all library activity and make sure the picker is empty. Turn off the power to the library.
3. Unplug the power cord from the back of the power supply.
4. Remove the two 6-32 x 3/8-inch Torx screws that attach the power supply to the library. Use a T-15 Torx screwdriver.

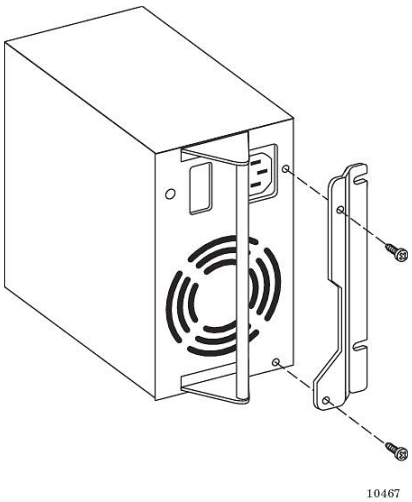
Figure 52 Screw locations on the base-module power supply



WARNING! The power supply might be hot.

5. Pull the handle on the power supply to remove it from the library.
6. The bracket is not part of the replacement kit. You must move the bracket from the original power supply to the new power supply. Remove the two 6-32 x 1/4-inch Torx screws that attach the bracket to the power supply with a T-15 Torx screwdriver.

Figure 53 Removing the base-module power supply bracket

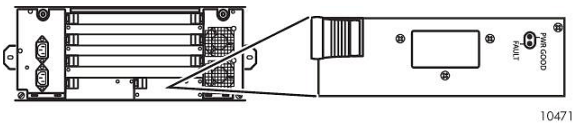


Replacing a power supply in the base module or tape drive expansion module

1. Attach the bracket to the new power supply with two 6-32 x 1/4-inch Torx screws. Use a T-15 Torx screwdriver.
2. Slide the power supply into the library.
3. Attach the power supply to the library with two 6-32 x 3/8-inch Torx screws.
4. Plug the power cord into the power supply.
5. If the power to the library was previously turned off, turn on the power to the library.

Power supply in the card cage expansion module

Part number	375816-001 or 409858-001
Location	Bottom of the card cage expansion module

Characteristics	• Hot-swappable and redundant • 3U x 8HP size with two LEDs
Function	Provides 100–240 VAC, 3 A, 47–63 Hz, to the card cage expansion module
Illustration	

Required tools

- #2 Phillips screwdriver

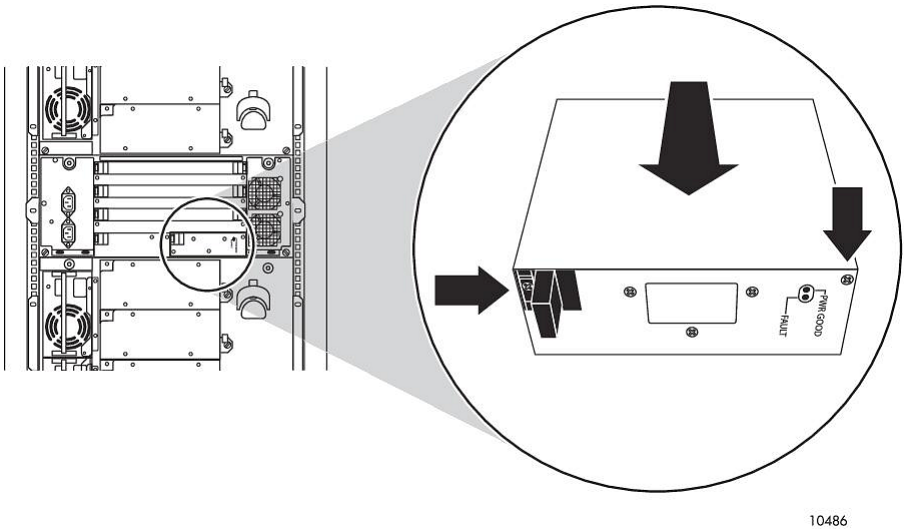
Removing a power supply from the card cage expansion module

1. Identify the power supply to be replaced. The FAULT LED light might be lit (see (page 48)).
2. Loosen the two captive screws. One screw is in the black ejector handle and the other screw is located on the top-right corner of the power supply back panel. Use a #2 Phillips screwdriver.

⚠ **WARNING!** The power supply might be hot.

3. Push the black ejector handle to the left.
4. Pull the ejector handle to remove the power supply from the library.

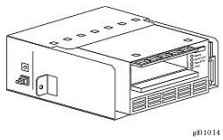
Figure 54 Removing a power supply from a card cage expansion module



Replacing a power supply in the card cage expansion module

1. Position the power supply as shown in (page 71). Align the power supply with the guides in the card cage and slide the power supply into the library.
2. Push the ejector handle to the right.
3. Tighten the two captive screws. Use a #2 Phillips screwdriver.

LTO2 or LTO3 tape drive

Part number	375817-001 or 409859-001 (Ultrium 460 or LTO2)381676-001 or 409860-001 (Ultrium 960 or LTO3)
Location	In the base module or tape drive expansion module
Characteristics	• Hot-swappable • 1/2-inch cartridge tape drive
Function	Writes data to and reads data from Linear Tape-Open (LTO) cartridges
Illustration	

Required tools

- Flat-blade screwdriver

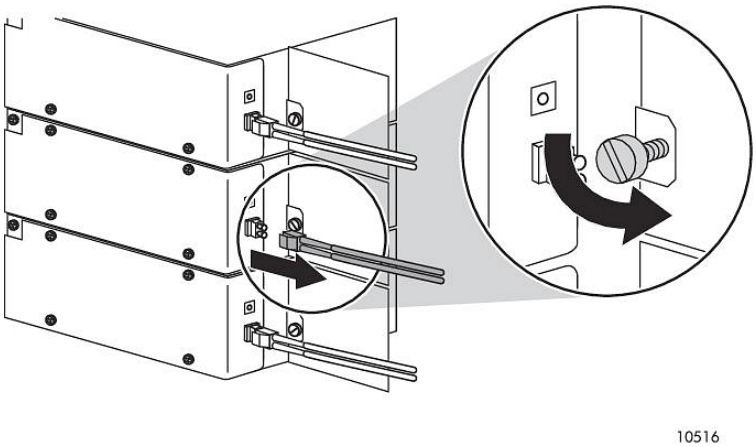
Removing an LTO2 or LTO3 tape drive

1. Identify the tape drive to be replaced. The FAULT LED light might be lit (see (page 45)).

CAUTION: To avoid damaging FC cables, do not pinch or sharply bend the cables tighter than a 5-cm (2-inches) diameter.

2. Unplug the FC cable from the tape drive.
3. Use your fingers or a flat-blade screwdriver to loosen the captive screw on the right side of the tape drive.
4. Pull the tape drive out of the library.

Figure 55 Removing a tape drive



Replacing an LTO2 or LTO3 tape drive

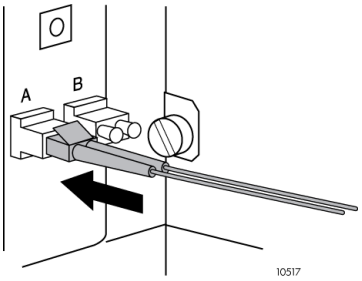
NOTE: HP recommends that you install tape drives from top to bottom, with no gaps between them. If you are installing LTO2 or LTO3 tape drives and LTO4 or later tape drives in the same library, HP recommends that you place all LTO2 and LTO3 tape drives above all LTO4 or later tape drives.

1. Insert the tape drive into an empty drive bay.
2. Tighten the captive screw to attach the tape drive to the drive bay.

CAUTION: To avoid damaging FC cables, do not pinch or sharply bend the cables tighter than a 5-cm (2-inches) diameter.

3. Connect the FC cable to the tape drive. The FC cable connector clicks into place.

Figure 56 Connecting the FC cable to a tape drive

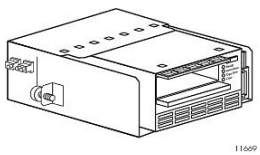


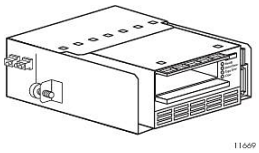
NOTE: Replacement tape drives placed into previously occupied drive bays are recognized by the library. Tape drives placed into previously vacant drive bays are not recognized until after a reboot.

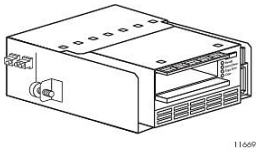
4. Make sure that the tape drive has the current firmware version. See the *HP Interface Manager and Command View TL User Guide* for detailed procedures on updating tape drive firmware.
5. Use the Command View TL user interface to reboot the interface controller. See the *HP Interface Manager and Command View TL User Guide* for detailed procedures.
6. Make sure the FC port LED for the corresponding tape drive on the interface controller is solid green (see (page 44) or (page 44)).
7. If the tape drive was installed in a previously vacant drive bay, reboot the library. On the OCP, select the **Operations→Reboot Library** command.
8. Check the tape drive status on the OCP to make sure that the tape drive is recognized. Alternatively, make sure Command View TL recognizes the new tape drive using the console.

LTO4 and later tape drives

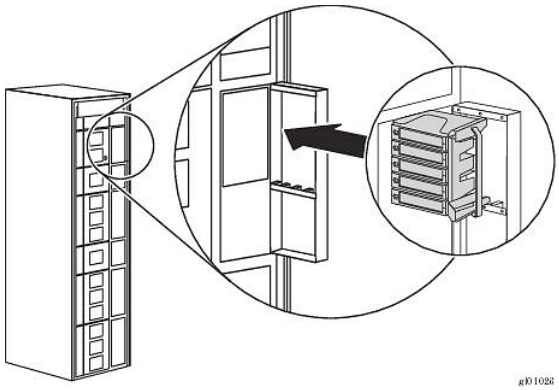
NOTE: For information on how to remove and replace LTO4 and later tape drives, see the separate *HP EML E-series LTO4 or Later Tape Drive Replacement Instructions* at http://www.hp.com/support/eml.

Part number	447790-001 (Ultrium 1840)
Location	In the base module or tape drive expansion module
Characteristics	• Hot-swappable • 1/2-inch cartridge tape drive
Function	Writes data to and reads data from Linear Tape-Open (LTO) cartridges
Illustration	

Part number	602100-001 (Ultrium 3280)
Location	In the base module or tape drive expansion module
Characteristics	• Hot-swappable • 1/2-inch cartridge tape drive
Function	Writes data to and reads data from Linear Tape-Open (LTO) cartridges
Illustration	

Part number	706800-001 (Ultrium 6650)
Location	In the base module or tape drive expansion module
Characteristics	• Hot-swappable • 1/2-inch cartridge tape drive
Function	Writes data to and reads data from Linear Tape-Open (LTO) cartridges
Illustration	

Load port magazine

Part number	375813-001
Location	Inside the load port door on the right side of the base module, tape drive expansion module, and capacity expansion module
Characteristics	One column, five slots
Function	Holding tape cartridges for placement into library
Illustration	

Removing a load port magazine

1. On the OCP, select the **Operations→Unlock Load Ports** command. All load port doors open.
2. Fully open the load port door.
3. Grab the handle and pull the magazine out of the load port along its track to remove it from the library.

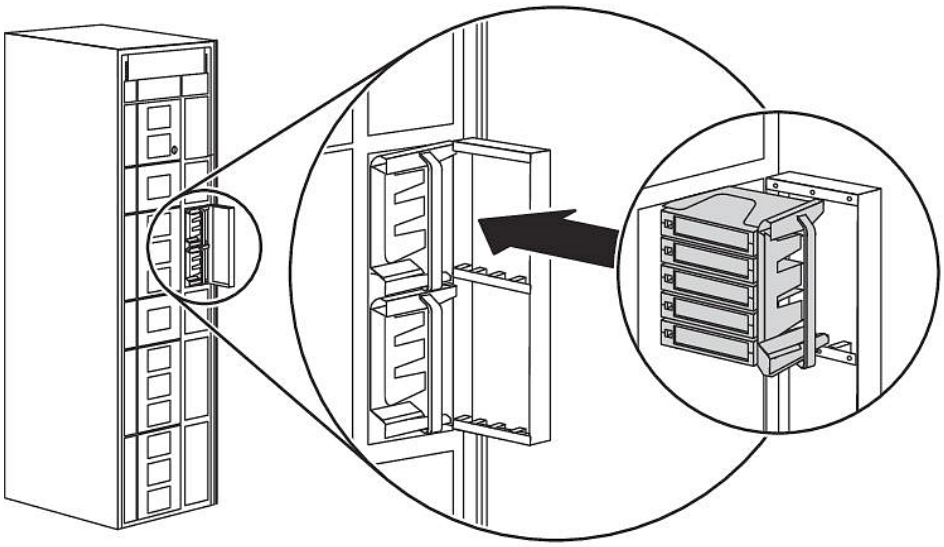
△ **CAUTION:** Guard plates prevent access to the inside of the library when a load port magazine is removed. These doors will move back out of the way when a magazine is reinserted. You should not attempt to otherwise move these guards, nor gain access to the library through the load ports.

Replacing a load port magazine

1. Align the magazine with the top and bottom track on the load port door, and slide the magazine through the spring door and fully into the load port.
2. Close the load port door.

3. After all load port doors are closed, the library does an inventory of the load ports.

Figure 57 Inserting a magazine into the load port



5 Moving the library

This section explains how to move or ship the library. To ship the library, or move it using a motor vehicle (for example, truck, or forklift), follow the instructions in this section. To move the library to a new location within the same building or facility, follow all instructions in this section except for those found in (page 78).

△ **CAUTION:** Moving or shipping the library without proper packaging materials can result in damage to library components. HP strongly recommends that an HP authorized service representative move a library to another location.

NOTE: These procedures require the original packaging materials of the library. If you do not have the original packaging materials, contact your support representative for ordering information.

Selecting an installation location

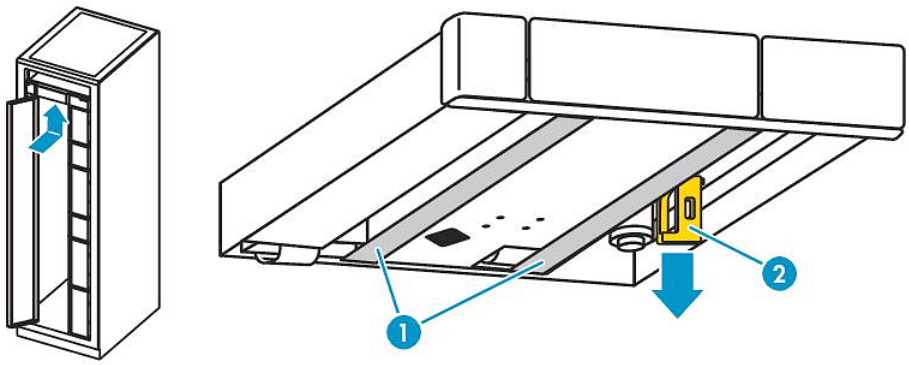
When choosing an installation site for the library, consider the requirements in the following sections.

Preparing the library for a short move

1. Remove all tape cartridges from the tape drives using your application software.
2. Roll the library carefully on level surfaces to its destination.

Preparing the library for long-distance relocation

1. Use your application software to remove all tape cartridges from the tape drives.
2. Remove all tape cartridges from the library slots.
3. Carefully pack all tape cartridges for shipment.
4. Install the shipping straps on the robot.
5. Push the yellow gear lock up to prevent movement of the reduction gear.



1. Shipping straps
2. Yellow gear lock

6. Disconnect all cables from hosts, switches, or local networks and pack them with other library accessories.
7. If the library needs to be crated, go to the next section.

Repacking the library

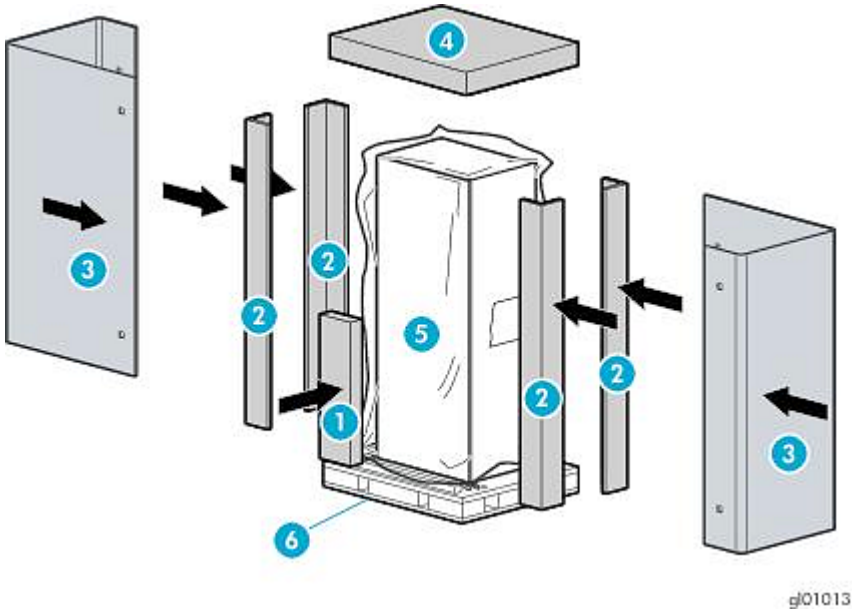
Use this section if you need to:

- Ship the library to the new site.
- Transport the library by forklift or similar means.

⚠ **WARNING!** Use at least two people to perform any steps that involve lifting or guiding the library.

1. Put the library on a shock pallet. If your library was delivered in a rack, use the shock pallet that came with the library. If your library was not delivered in a rack, use your own shock pallet.
   a. Raise the library support feet.
   b. With the help of at least one person, roll the library to a position in front of the pallet ramp.
   c. Roll the library onto the pallet.
2. Secure the library:
   a. Place the antistatic bag over the library, and secure it into place.
   b. Use the four shipping bolts to secure the library to the pallet.
   c. Remove the ramps from the pallet and place them in a box.
3. Place the ramp box and accessory kits onto the pallet.
4. Place the four corner posts against the rack.
5. Wrap the cardboard sheets around the library, and fasten using the plastic restraining clips.
6. Place the top (cap) onto the packed library.
7. Secure the packed library with two restraining bands.

Figure 58 Repacking the library



1. Ramps
2. Corner posts
3. Corrugated sheets
4. Cap
5. Antistatic bag
6. Shock pallet

Preparing the library for operation

After shipping or moving the library, see the *Getting Started* manual for your library to:

- Prepare the new installation site.
- Receive the library.
- Uncrate the library.
- Position the library.
- Remove the robotics unit shipping restraints.
- Install and configure the library.

6 Support and other resources

- "Contacting HP" (page 80)
- "Related information" (page 80)
- Document conventions and symbols

Contacting HP

Go to www.hp.com/support/cvtl for the latest troubleshooting information, firmware updates, software versions, and documentation.

Before contacting HP, collect the following information:

- Product model names and numbers
- Technical support registration number (if applicable)
- Product serial numbers
- Error messages
- Operating system type and revision level
- Detailed questions

For worldwide technical support information, see the HP support website:

http://www.hp.com/support

Related information

The following sections present related information, including:

- Related documentation
- HP web sites

Related documentation

The following documents and websites provide related information:

- *ESL E-Series Interface Manager poster*
- *ESL9000 Series Interface Manager Replacement Instructions poster*
- *EML E-Series Interface Manager replacement poster*
- *HP Command View TL SMI-S Provider installation instructions*
- *HP Enterprise Systems Library (ESL) G3 Tape Library User Guide*

You can find these documents from the Manuals page of the HP Business Support Center website:

http://www.hp.com/support/manuals

In the Storage section, click **Storage Software** or **Tape Storage and Media** and then select your product.

HP websites

For additional information, see the following HP websites:

- http://www.hp.com
- http://www.hp.com/go/storage
- http://www.hp.com/support/manuals

- http://www.hp.com/support/downloads
- http://www.hp.com/go/tapeassure

HP tape cartridges

To make sure you get the best performance from your tape library, always use HP branded tape cartridges. HP develops, tests, and qualifies their hardware and tape cartridges together to ensure compatibility, and enabling you to keep your data safe. To learn more about HP tape cartridges or to order online, go to the HP website:
www.hp.com/go/storagemedia

Product warranties

For information about product warranties, see the warranty information website:
http://www.hp.com/go/storagewarranty

Subscription services

HP recommends that you register your product at the Subscriber's Choice for Business website:
http://www.hp.com/go/e-updates

After registering, you will receive e-mail notification of product enhancements, new driver versions, firmware updates, and other product resources.

Typographic conventions

Table 29 Document conventions

Convention	Element
Blue text: Table 29 (page 81)	Cross-reference links and e-mail addresses
Blue, underlined text: http://www.hp.com	Website addresses
Bold text	• Keys that are pressed • Text entered into a GUI element, such as a box • GUI elements that are clicked or selected, such as menu and list items, buttons, tabs, and check boxes
Italic text	Text emphasis
`Monospace` text	• File and directory names • System output • Code • Commands, their arguments, and argument values
`Monospace, italic` text	• Code variables • Command variables
`Monospace, bold` text	Emphasized monospace text

⚠ **WARNING!** Indicates that failure to follow directions could result in bodily harm or death.

⚠ **CAUTION:** Indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT: Provides clarifying information or specific instructions.

NOTE: Provides additional information.

TIP: Provides helpful hints and shortcuts.

Updated regulatory compliance and recycling notices

For regulatory and recycling notices see *HP StorageWorks ESL E-Series Tape Library users guide* or *HP StorageWorks Enterprise Modular Library E-Series user guide*.

7 Documentation feedback

Send any errors, suggestions, or comments to Documentation Feedback (**docsfeedback@hp.com**).

A Specifications and characteristics

Library component specifications

Table 30 Library component specifications

Characteristic	Specification
10642 rack with 1 PDU	
Physical:	
Weight	114.84 kg (253 lb)
Dimensions (HxDxW)	199.9 x 100.8 x 61.0 cm (78.7 x 39.7 x 24 in)
Electrical:	
AC voltage range	200–240 V, 50/60 Hz
Load capacity	3680 VA (@ 230 VAC)
Base module (12U) with 1 power supply, 2 tape drives, and robot (base module consists of base unit (8U) and tape drive expansion module (4U)	
Physical:	
Weight, base module	45 kg (98 lb)
Weight, tape drive expansion module	20.5 kg (44.8 lb)
Dimensions (HxDxW), base module	35.6 x 81.1 x 48.0 cm (14.0 x 31.9 x 18.9 in)
Dimensions (HxDxW), tape drive expansion module	17.8 x 81.1 x 48.0 cm (7.0 x 31.9 x 18.9 in)
Electrical:	
Power rating	2 A (at 200 VAC) combined max peak
Card cage expansion module (4U)	
Physical:	
Weight (with 1 power supply and 3 interface controllers)	20 kg (43.8 lb)
Dimensions (HxDxW)	17.8 x 76.3 x 48.0 cm (7.0 x 30.0 x 18.9 in)
Electrical:	
Power rating	1.25 A (at 200 VAC)
Tape drive expansion module (8U) with 1 power supply and 4 tape drives	
Physical:	
Weight	41 kg (90.0 lb)
Dimensions (HxDxW)	35.6 x 81.1 x 48.0 cm (14.0 x 31.9 x 18.9 in)
Electrical:	
Input power	288 Watts
Power rating	297 VA
Input current	1.5 A (at 200 VAC)
Capacity expansion module (8U)	
Physical:	

Table 30 Library component specifications *(continued)*

Characteristic	Specification
Weight	20.1 kg (44.2 lb)
Dimensions (HxDxW)	35.6 x 81.1 x 48.0 cm (14.0 x 31.9 x 18.9 in)
Electrical	
Power rating	0.8 A (at 240 VAC)
Main power supply	
Weight	2.3 kg (5.4 lb)
Card cage expansion module power supply	
Weight	0.8 kg (1.8 lb)
LTO Ultrium tape drive and tray	
Weight	3.6 kg (7.9 lb)
LTO Ultrium cartridge	
Weight	220 g (7.8 oz)
e2400-FC 2Gb interface controller	
Dimensions	6U wide x 4HP tall
Power requirements	3.3 VDC, 1.5 A typ., 4.95 W, 2.85 A for 4 ms5.0 VDC, 2.7 A typ., 13.50 W, 3.2 A for 0.7 secTotal power=18.45 W
e2400-FC 4Gb interface controller	
Dimensions	4U wide x 8HP tall
Power requirements	3.3 VDC +/- 100 mV; 7.5 A peak operating current; 25 W peak operating power5.0 VDC +/- 100 mV; 5 A peak operating current; 25 W operating power
Interface Manager card	
Dimensions	4U wide x 4HP tall
Power requirements	3.3 VDC, 0.65 A typ., 2.14 W, 2.0 A5.0 VDC, 0.8 A typ., 4.0 W, 2.0 A Total power=6.14 W

Library environmental specifications

Table 31 Library environmental specifications

Item	Measurements		
	Operating	**Storage**	**Transporting**
Temperature	+10 to +35°C (+50 to +95°F)	+10 to +40°C (+50 to +104°F)	-40 to +60°C (-40 to +140°F)
Humidity	20 to 80%	10 to 95%	10 to 95%
Wet bulb (maximum, noncondensing)	+29.2°C (+84.5°F)	+35°C (+95°F)	+35°C (+95°F)
Altitude	76 to 4,500 m (-250 to 15,000 ft)		

Acoustics

Table 32 Acoustics

Item	Operating	Idle
Sound power	7.5 Bels (A)	7.5 Bels (A)
Sound pressure Bystander position	7.5 Bels (A) (60 dB)	7.5 Bels (A)

Ultrium tape drive comparisons

Table 33 Ultrium tape drive comparisons

Characteristic	Ultrium 460	Ultrium 960	Ultrium 1840	Ultrium 3280
Capacity (native)	200 GB	400 GB	800 GB	1.5 TB
Transfer rate (native)	Up to 30 MB/sec[1]	Up to 80 MB/sec[1]	Up to 120 MB/sec[1]	140 MB/sec[1]
Data rate matching	10-30 MB/sec	27-80 MB/sec	40-120 MB/sec	47-140 MB/sec
Host interfaces	2 Gb/sec FC	2 Gb/sec FC	4 Gb/sec FC	8 Gb/secFC
Head channels	8	16	16	16
Bit density	7.40 Kb/mm (188 Kb/inch)	9.64 Kb/mm (244.9 Kb/inch)	13.52 Kb/mm (343.4 Kb/in)	13.52 Kb/mm (343.4 Kb/in)
Number of tracks	512	704	896	896
Length	609 m	680 m	820 m	820 m
WORM support	No	Yes	Yes	Yes
Compatibility				
Write	Ultrium Gen. 1, 2	Ultrium Gen. 2, 3	Ultrium Gen. 3, 4	Ultrium Gen. 4, 5
Read	Ultrium Gen. 1, 2	Ultrium Gen. 1, 2, 3	Ultrium Gen. 2, 3, 4	Ultrium Gen. 3, 4, 5

[1] HP classifies the performance of the Ultrium drives as 1000 x 1000 bytes per second (that is, in base 10) in common with most other disk and tape drive vendors. Most applications, however, measure performance as 1024 x 1024 bytes per second.

B Regulatory statements

Federal Communications Commission notice

Part 15 of the Federal Communications Commission (FCC) Rules and Regulations has established Radio Frequency (RF) emission limits to provide an interference-free radio frequency spectrum. Many electronic devices, including computers, generate RF energy incidental to their intended function and are, therefore, covered by these rules. These rules place computers and related peripheral devices into two classes, A and B, depending upon their intended installation. Class A devices are those that may reasonably be expected to be installed in a business or commercial environment. Class B devices are those that may reasonably be expected to be installed in a residential environment (for example, personal computers). The FCC requires devices in both classes to bear a label indicating the interference potential of the device as well as additional operating instructions for the user.

FCC rating label

The FCC rating label on the device shows the classification (A or B) of the equipment. Class B devices have an FCC logo or ID on the label. Class A devices do not have an FCC logo or ID on the label. After you determine the class of the device, refer to the corresponding statement.

Class A equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

Class B equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reposition or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Declaration of Conformity for products marked with the FCC logo, United States only

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause und operation.

For questions regarding this FCC declaration, contact us by mail or telephone:

- Hewlett-Packard Company P.O. Box 692000, Mail Stop 510101 Houston, Texas 77269-2000
- Or call 1-281-514-3333

Modification

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Hewlett-Packard Company may void the user's authority to operate the equipment.

Cables

When provided, connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Canadian notice (Avis Canadien)

Class A equipment

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la class A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B equipment

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la class B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union notice

This product complies with the following EU directives:

- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC

Compliance with these directives implies conformity to applicable harmonized European standards (European Norms) which are listed on the EU Declaration of Conformity issued by Hewlett-Packard for this product or product family.

This compliance is indicated by the following conformity marking placed on the product:

CE	This marking is valid for non-Telecom products and EU harmonized Telecom products (e.g., Bluetooth).

Certificates can be obtained from http://www.hp.com/go/certificates.

Hewlett-Packard GmbH, HQ-TRE, Herrenberger Strasse 140, 71034 Boeblingen, Germany

Japanese notices

Japanese VCCI-A notice

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者は適切な対策を講ずるよう要求されることがあります。

VCCI-A

Japanese VCCI-B notice

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

Japanese power cord statement

製品には、同梱された電源コードをお使い下さい。
同梱された電源コードは、他の製品では使用出来ません。

Please use the attached power cord.
The attached power cord is not allowed to use with other product.

Korean notices

Class A equipment

A급 기기 (업무용 정보통신기기)

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 만약 잘못판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Class B equipment

B급 기기 (가정용 정보통신기기)

이 기기는 가정용으로 전자파적합등록을 한 기기로서 주거지역에서는 물론 모든지역에서 사용할 수 있습니다.

Taiwanese notices

BSMI Class A notice

警告使用者:

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Taiwan battery recycle statement

Turkish recycling notice

Türkiye Cumhuriyeti: EEE Yönetmeliğine Uygundur

Laser compliance notices

English laser notice

This device may contain a laser that is classified as a Class 1 Laser Product in accordance with U.S. FDA regulations and the IEC 60825-1. The product does not emit hazardous laser radiation.

⚠ **WARNING!** Use of controls or adjustments or performance of procedures other than those specified herein or in the laser product's installation guide may result in hazardous radiation exposure. To reduce the risk of exposure to hazardous radiation:

- Do not try to open the module enclosure. There are no user-serviceable components inside.
- Do not operate controls, make adjustments, or perform procedures to the laser device other than those specified herein.
- Allow only HP Authorized Service technicians to repair the unit.

The Center for Devices and Radiological Health (CDRH) of the U.S. Food and Drug Administration implemented regulations for laser products on August 2, 1976. These regulations apply to laser products manufactured from August 1, 1976. Compliance is mandatory for products marketed in the United States.

Dutch laser notice

WAARSCHUWING: dit apparaat bevat mogelijk een laser die is geclassificeerd als een laserproduct van Klasse 1 overeenkomstig de bepalingen van de Amerikaanse FDA en de richtlijn IEC 60825-1. Dit product geeft geen gevaarlijke laserstraling af.

Als u bedieningselementen gebruikt, instellingen aanpast of procedures uitvoert op een andere manier dan in deze publicatie of in de installatiehandleiding van het laserproduct wordt aangegeven, loopt u het risico te worden blootgesteld aan gevaarlijke straling. Het risico van blootstelling aan gevaarlijke straling beperkt u als volgt:

- Probeer de behuizing van de module niet te openen. U mag zelf geen onderdelen repareren.
- Gebruik voor de laserapparatuur geen andere knoppen of instellingen en voer geen andere aanpassingen of procedures uit dan die in deze handleiding worden beschreven.
- Alleen door HP geautoriseerde technici mogen het apparaat repareren.

French laser notice

AVERTISSEMENT : cet appareil peut être équipé d'un laser classé en tant que Produit laser de classe 1 et conforme à la réglementation de la FDA américaine et à la norme 60825-1 de l'IEC. Ce produit n'émet pas de rayonnement dangereux.

L'utilisation de commandes, de réglages ou de procédures autres que ceux qui sont indiqués ici ou dans le manuel d'installation du produit laser peut exposer l'utilisateur à des rayonnements dangereux. Pour réduire le risque d'exposition à des rayonnements dangereux :

- Ne tentez pas d'ouvrir le boîtier renfermant l'appareil laser. Il ne contient aucune pièce dont la maintenance puisse être effectuée par l'utilisateur.
- Tout contrôle, réglage ou procédure autre que ceux décrits dans ce chapitre ne doivent pas être effectués par l'utilisateur.
- Seuls les Mainteneurs Agréés HP sont habilités à réparer l'appareil laser.

German laser notice

VORSICHT: Dieses Gerät enthält möglicherweise einen Laser, der nach den US-amerikanischen FDA-Bestimmungen und nach IEC 60825-1 als Laserprodukt der Klasse 1 zertifiziert ist. Gesundheitsschädliche Laserstrahlen werden nicht emittiert.

Die Anleitungen in diesem Dokument müssen befolgt werden. Bei Einstellungen oder Durchführung sonstiger Verfahren, die über die Anleitungen in diesem Dokument bzw. im Installationshandbuch des Lasergeräts hinausgehen, kann es zum Austritt gefährlicher Strahlung kommen. Zur Vermeidung der Freisetzung gefährlicher Strahlungen sind die folgenden Punkte zu beachten:

- Versuchen Sie nicht, die Abdeckung des Lasermoduls zu öffnen. Im Inneren befinden sich keine Komponenten, die vom Benutzer gewartet werden können.
- Benutzen Sie das Lasergerät ausschließlich gemäß den Anleitungen und Hinweisen in diesem Dokument.
- Lassen Sie das Gerät nur von einem HP Servicepartner reparieren.

Italian laser notice

AVVERTENZA: AVVERTENZA Questo dispositivo può contenere un laser classificato come prodotto laser di Classe 1 in conformità alle normative US FDA e IEC 60825-1. Questo prodotto non emette radiazioni laser pericolose.

L'eventuale esecuzione di comandi, regolazioni o procedure difformi a quanto specificato nella presente documentazione o nella guida di installazione del prodotto può causare l'esposizione a radiazioni nocive. Per ridurre i rischi di esposizione a radiazioni pericolose, attenersi alle seguenti precauzioni:

- Non cercare di aprire il contenitore del modulo. All'interno non vi sono componenti soggetti a manutenzione da parte dell'utente.
- Non eseguire operazioni di controllo, regolazione o di altro genere su un dispositivo laser ad eccezione di quelle specificate da queste istruzioni.
- Affidare gli interventi di riparazione dell'unità esclusivamente ai tecnici dell'Assistenza autorizzata HP.

Japanese laser notice

警告：本製品には、US FDA規則およびIEC 60825-1に基づくClass 1レーザー製品が含まれている場合があります。本製品は人体に危険なレーザー光は発しません。

本書およびレーザー製品のインストール ガイドに示されている以外の方法で制御、調整、使用した場合、人体に危険な光線にさらされる場合があります。人体に危険な光線にさらされないため、以下の項目を守ってください。

- モジュール エンクロージャを開けないでください。ユーザーが取り扱えるコンポーネントは含まれていません。
- 本書に示されている以外の方法で、レーザー デバイスを制御、調整、使用しないでください。
- HPの正規サービス技術者のみが本ユニットの修理を許可されています。

Spanish laser notice

ADVERTENCIA: Este dispositivo podría contener un láser clasificado como producto de láser de Clase 1 de acuerdo con la normativa de la FDA de EE.UU. e IEC 60825-1. El producto no emite radiaciones láser peligrosas.

El uso de controles, ajustes o manipulaciones distintos de los especificados aquí o en la guía de instalación del producto de láser puede producir una exposición peligrosa a las radiaciones. Para evitar el riesgo de exposición a radiaciones peligrosas:

- No intente abrir la cubierta del módulo. Dentro no hay componentes que el usuario pueda reparar.
- No realice más operaciones de control, ajustes o manipulaciones en el dispositivo láser que los aquí especificados.
- Sólo permita reparar la unidad a los agentes del servicio técnico autorizado HP.

Recycling notices

English recycling notice

Disposal of waste equipment by users in private household in the European Union

This symbol means do not dispose of your product with your other household waste. Instead, you should protect human health and the environment by handing over your waste equipment to a designated collection point for the recycling of waste electrical and electronic equipment. For more information, please contact your household waste disposal service

Bulgarian recycling notice

Изхвърляне на отпадъчно оборудване от потребители в частни домакинства в Европейския съюз

Този символ върху продукта или опаковката му показва, че продуктът не трябва да се изхвърля заедно с другите битови отпадъци. Вместо това, трябва да предпазите човешкото здраве и околната среда, като предадете отпадъчното оборудване в предназначен за събирането му пункт за рециклиране на неизползваемо електрическо и електронно борудване. За допълнителна информация се свържете с фирмата по чистота, чиито услуги използвате.

Czech recycling notice

Likvidace zařízení v domácnostech v Evropské unii

Tento symbol znamená, že nesmíte tento produkt likvidovat spolu s jiným domovním odpadem. Místo toho byste měli chránit lidské zdraví a životní prostředí tím, že jej předáte na k tomu určené sběrné pracoviště, kde se zabývají recyklací elektrického a elektronického vybavení. Pro více informací kontaktujte společnost zabývající se sběrem a svozem domovního odpadu.

Danish recycling notice

Bortskaffelse af brugt udstyr hos brugere i private hjem i EU

Dette symbol betyder, at produktet ikke må bortskaffes sammen med andet husholdningsaffald. Du skal i stedet den menneskelige sundhed og miljøet ved at afl evere dit brugte udstyr på et dertil beregnet indsamlingssted for af brugt, elektrisk og elektronisk udstyr. Kontakt nærmeste renovationsafdeling for yderligere oplysninger.

Dutch recycling notice

Inzameling van afgedankte apparatuur van particuliere huishoudens in de Europese Unie

Dit symbool betekent dat het product niet mag worden gedeponeerd bij het overige huishoudelijke afval. Bescherm de gezondheid en het milieu door afgedankte apparatuur in te leveren bij een hiervoor bestemd inzamelpunt voor recycling van afgedankte elektrische en elektronische apparatuur. Neem voor meer informatie contact op met uw gemeentereinigingsdienst.

Estonian recycling notice

Äravisatavate seadmete likvideerimine Euroopa Liidu eramajapidamistes

See märk näitab, et seadet ei tohi visata olmeprügi hulka. Inimeste tervise ja keskkonna säästmise nimel tuleb äravisatav toode tuua elektriliste ja elektrooniliste seadmete käitlemisega egelevasse kogumispunkti. Küsimuste korral pöörduge kohaliku prügikäitlusettevõtte poole.

Finnish recycling notice

Kotitalousjätteiden hävittäminen Euroopan unionin alueella

Tämä symboli merkitsee, että laitetta ei saa hävittää muiden kotitalousjätteiden mukana. Sen sijaan sinun on suojattava ihmisten terveyttä ja ympäristöä toimittamalla käytöstä poistettu laite sähkö- tai elektroniikkajätteen kierrätyspisteeseen. Lisätietoja saat jätehuoltoyhtiöltä.

French recycling notice

Mise au rebut d'équipement par les utilisateurs privés dans l'Union Européenne

Ce symbole indique que vous ne devez pas jeter votre produit avec les ordures ménagères. Il est de votre responsabilité de protéger la santé et l'environnement et de vous débarrasser de votre équipement en le remettant à une déchetterie effectuant le recyclage des équipements électriques et électroniques. Pour de plus amples informations, prenez contact avec votre service d'élimination des ordures ménagères.

German recycling notice

Entsorgung von Altgeräten von Benutzern in privaten Haushalten in der EU

Dieses Symbol besagt, dass dieses Produkt nicht mit dem Haushaltsmüll entsorgt werden darf. Zum Schutze der Gesundheit und der Umwelt sollten Sie stattdessen Ihre Altgeräte zur Entsorgung einer dafür vorgesehenen Recyclingstelle für elektrische und elektronische Geräte übergeben. Weitere Informationen erhalten Sie von Ihrem Entsorgungsunternehmen für Hausmüll.

Greek recycling notice

Απόρριψη άχρηστου εξοπλισμού από ιδιώτες χρήστες στην Ευρωπαϊκή 'Ενωση

Αυτό το σύμβολο σημαίνει ότι δεν πρέπει να απορρίψετε το προϊόν με τα λοιπά οικιακά απορρίμματα. Αντίθετα, πρέπει να προστατέψετε την ανθρώπινη υγεία και το περιβάλλον παραδίδοντας τον άχρηστο εξοπλισμό σας σε εξουσιοδοτημένο σημείο συλλογής για την ανακύκλωση άχρηστου ηλεκτρικού και ηλεκτρονικού εξοπλισμού. Για περισσότερες πληροφορίες, επικοινωνήστε με την υπηρεσία απόρριψης απορριμμάτων της περιοχής σας.

Hungarian recycling notice

A hulladék anyagok megsemmisítése az Európai Unió háztartásaiban

Ez a szimbólum azt jelzi, hogy a készüléket nem szabad a háztartási hulladékkal együtt kidobni. Ehelyett a leselejtezett berendezéseknek az elektromos vagy elektronikus hulladék átvételére kijelölt helyen történő beszolgáltatásával megóvja az emberi egészséget és a környezetet.További információt a helyi köztisztasági vállalattól kaphat.

Italian recycling notice

Smaltimento di apparecchiature usate da parte di utenti privati nell'Unione Europea

Questo simbolo avvisa di non smaltire il prodotto con i normali rifi uti domestici. Rispettare la salute umana e l'ambiente conferendo l'apparecchiatura dismessa a un centro di raccolta designato per il riciclo di apparecchiature elettroniche ed elettriche. Per ulteriori informazioni, rivolgersi al servizio per lo smaltimento dei rifi uti domestici.

Latvian recycling notice

Europos Sąjungos namų ūkio vartotojų įrangos atliekų šalinimas

Šis simbolis nurodo, kad gaminio negalima išmesti kartu su kitomis buitinėmis atliekomis. Kad apsaugotumėte žmonių sveikatą ir aplinką, pasenusią nenaudojamą įrangą turite nuvežti į elektrinių ir elektroninių atliekų surinkimo punktą. Daugiau informacijos teiraukitės buitinių atliekų surinkimo tarnybos.

Lithuanian recycling notice

Nolietotu iekārtu iznīcināšanas noteikumi lietotājiem Eiropas Savienības privātajās mājsaimniecībās

Šis simbols norāda, ka ierīci nedrīkst utilizēt kopā ar citiem mājsaimniecības atkritumiem. Jums jārūpējas par cilvēku veselības un vides aizsardzību, nododot lietoto aprīkojumu otrreizējai pārstrādei īpašā lietotu elektrisko un elektronisko ierīču savākšanas punktā. Lai iegūtu plašāku informāciju, lūdzu, sazinieties ar savu mājsaimniecības atkritumu likvidēšanas dienestu.

Polish recycling notice

Utylizacja zużytego sprzętu przez użytkowników w prywatnych gospodarstwach domowych w krajach Unii Europejskiej

Ten symbol oznacza, że nie wolno wyrzucać produktu wraz z innymi domowymi odpadkami. Obowiązkiem użytkownika jest ochrona zdrowa ludzkiego i środowiska przez przekazanie zużytego sprzętu do wyznaczonego punktu zajmującego się recyklingiem odpadów powstałych ze sprzętu elektrycznego i elektronicznego. Więcej informacji można uzyskać od lokalnej firmy zajmującej wywozem nieczystości.

Portuguese recycling notice

Descarte de equipamentos usados por utilizadores domésticos na União Europeia

Este símbolo indica que não deve descartar o seu produto juntamente com os outros lixos domiciliares. Ao invés disso, deve proteger a saúde humana e o meio ambiente levando o seu equipamento para descarte em um ponto de recolha destinado à reciclagem de resíduos de equipamentos eléctricos e electrónicos. Para obter mais informações, contacte o seu serviço de tratamento de resíduos domésticos.

Romanian recycling notice

Casarea echipamentului uzat de către utilizatorii casnici din Uniunea Europeană

Acest simbol înseamnă să nu se arunce produsul cu alte deșeuri menajere. În schimb, trebuie să protejați sănătatea umană și mediul predând echipamentul uzat la un punct de colectare desemnat pentru reciclarea echipamentelor electrice și electronice uzate. Pentru informații suplimentare, vă rugăm să contactați serviciul de eliminare a deșeurilor menajere local.

Slovak recycling notice

Likvidácia vyradených zariadení používateľmi v domácnostiach v Európskej únii

Tento symbol znamená, že tento produkt sa nemá likvidovať s ostatným domovým odpadom. Namiesto toho by ste mali chrániť ľudské zdravie a životné prostredie odovzdaním odpadového zariadenia na zbernom mieste, ktoré je určené na recykláciu odpadových elektrických a elektronických zariadení. Ďalšie informácie získate od spoločnosti zaoberajúcej sa likvidáciou domového odpadu.

Spanish recycling notice

Eliminación de los equipos que ya no se utilizan en entornos domésticos de la Unión Europea

Este símbolo indica que este producto no debe eliminarse con los residuos domésticos. En lugar de ello, debe evitar causar daños a la salud de las personas y al medio ambiente llevando los equipos que no utilice a un punto de recogida designado para el reciclaje de equipos eléctricos y electrónicos que ya no se utilizan. Para obtener más información, póngase en contacto con el servicio de recogida de residuos domésticos.

Swedish recycling notice

Hantering av elektroniskt avfall för hemanvändare inom EU

Den här symbolen innebär att du inte ska kasta din produkt i hushållsavfallet. Värna i stället om natur och miljö genom att lämna in uttjänt utrustning på anvisad insamlingsplats. Allt elektriskt och elektroniskt avfall går sedan vidare till återvinning. Kontakta ditt återvinningsföretag för mer information.

Battery replacement notices

Dutch battery notice

Verklaring betreffende de batterij

WAARSCHUWING: dit apparaat bevat mogelijk een batterij.

- Probeer de batterijen na het verwijderen niet op te laden.
- Stel de batterijen niet bloot aan water of temperaturen boven 60° C.
- De batterijen mogen niet worden beschadigd, gedemonteerd, geplet of doorboord.
- Zorg dat u geen kortsluiting veroorzaakt tussen de externe contactpunten en laat de batterijen niet in aanraking komen met water of vuur.
- Gebruik ter vervanging alleen door HP goedgekeurde batterijen.

Batterijen, accu's en accumulators mogen niet worden gedeponeerd bij het normale huishoudelijke afval. Als u de batterijen/accu's wilt inleveren voor hergebruik of op de juiste manier wilt vernietigen, kunt u gebruik maken van het openbare inzamelingssysteem voor klein chemisch afval of ze terugsturen naar HP of een geautoriseerde HP Business of Service Partner.

Neem contact op met een geautoriseerde leverancier of een Business of Service Partner voor meer informatie over het vervangen of op de juiste manier vernietigen van accu's.

French battery notice

Avis relatif aux piles

AVERTISSEMENT : cet appareil peut contenir des piles.

- N'essayez pas de recharger les piles après les avoir retirées.
- Évitez de les mettre en contact avec de l'eau ou de les soumettre à des températures supérieures à 60°C.
- N'essayez pas de démonter, d'écraser ou de percer les piles.
- N'essayez pas de court-circuiter les bornes de la pile ou de jeter cette dernière dans le feu ou l'eau.
- Remplacez les piles exclusivement par des pièces de rechange HP prévues pour ce produit.

Les piles, modules de batteries et accumulateurs ne doivent pas être jetés avec les déchets ménagers. Pour permettre leur recyclage ou leur élimination, veuillez utiliser les systèmes de collecte publique ou renvoyez-les à HP, à votre Partenaire Agréé HP ou aux agents agréés.

Contactez un Revendeur Agréé ou Mainteneur Agréé pour savoir comment remplacer et jeter vos piles.

German battery notice

Hinweise zu Batterien und Akkus

VORSICHT: Dieses Produkt enthält unter Umständen eine Batterie oder einen Akku.

- Versuchen Sie nicht, Batterien und Akkus außerhalb des Gerätes wieder aufzuladen.
- Schützen Sie Batterien und Akkus vor Feuchtigkeit und Temperaturen über 60°.
- Verwenden Sie Batterien und Akkus nicht missbräuchlich, nehmen Sie sie nicht auseinander und vermeiden Sie mechanische Beschädigungen jeglicher Art.
- Vermeiden Sie Kurzschlüsse, und setzen Sie Batterien und Akkus weder Wasser noch Feuer aus.
- Ersetzen Sie Batterien und Akkus nur durch die von HP vorgesehenen Ersatzteile.

Batterien und Akkus dürfen nicht über den normalen Hausmüll entsorgt werden. Um sie der Wiederverwertung oder dem Sondermüll zuzuführen, nutzen Sie die öffentlichen Sammelstellen, oder setzen Sie sich bezüglich der Entsorgung mit einem HP Partner in Verbindung.

Weitere Informationen zum Austausch von Batterien und Akkus oder zur sachgemäßen Entsorgung erhalten Sie bei Ihrem HP Partner oder Servicepartner.

Italian battery notice

Istruzioni per la batteria

AVVERTENZA: Questo dispositivo può contenere una batteria.

- Non tentare di ricaricare le batterie se rimosse.
- Evitare che le batterie entrino in contatto con l'acqua o siano esposte a temperature superiori a 60° C.
- Non smontare, schiacciare, forare o utilizzare in modo improprio la batteria.
- Non accorciare i contatti esterni o gettare in acqua o sul fuoco la batteria.
- Sostituire la batteria solo con i ricambi HP previsti a questo scopo.

Le batterie e gli accumulatori non devono essere smaltiti insieme ai rifiuti domestici. Per procedere al riciclaggio o al corretto smaltimento, utilizzare il sistema di raccolta pubblico dei rifiuti o restituirli a HP, ai Partner Ufficiali HP o ai relativi rappresentanti.

Per ulteriori informazioni sulla sostituzione e sullo smaltimento delle batterie, contattare un Partner Ufficiale o un Centro di assistenza autorizzato.

Japanese battery notice

バッテリに関する注意

警告:本製品はバッテリを内蔵している場合があります。

- バッテリを取り外している場合は、充電しないでください。
- バッテリを水にさらしたり、60°C (140°F) 以上の温度にさらさないでください。
- バッテリを誤用、分解、破壊したり、穴をあけたりしないでください。
- 外部極を短絡させたり、火や水に投棄しないでください。
- バッテリを交換する際は、HP指定の製品と交換してください。

バッテリ、バッテリ パック、蓄電池は一般の家庭廃棄物と一緒に廃棄しないでください。リサイクルまたは適切に廃棄するため、公共の収集システム、HP、HPパートナー、またはHPパートナーの代理店にお送りください。

バッテリ交換および適切な廃棄方法についての情報は、HPのサポート窓口にお問い合わせください。

Spanish battery notice

Declaración sobre las baterías

ADVERTENCIA: Este dispositivo podría contener una batería.

- No intente recargar las baterías si las extrae.
- Evite el contacto de las baterías con agua y no las exponga a temperaturas superiores a los 60 °C (140 °F).
- No utilice incorrectamente, ni desmonte, aplaste o pinche las baterías.
- No cortocircuite los contactos externos ni la arroje al fuego o al agua.
- Sustituya las baterías sólo por el repuesto designado por HP.

Las baterías, los paquetes de baterías y los acumuladores no se deben eliminar junto con los desperdicios generales de la casa. Con el fin de tirarlos al contenedor de reciclaje adecuado, utilice los sistemas públicos de recogida o devuélvalas a HP, un distribuidor autorizado de HP o sus agentes.

Para obtener más información sobre la sustitución de la batería o su eliminación correcta, consulte con su distribuidor o servicio técnico autorizado.

C Ordering HP tape cartridges and barcode label packs

Where to buy tape cartridges and barcode labels

HP recommends using HP tape cartridges in your HP StorageWorks tape library. These can be purchased directly from HP, or through an authorized reseller or sales office.

- For the location of an HP authorized reseller:
  - Call 1-800-345-1518 (U.S. only).
  - Call 1-800-263-5868 (Canada only).
  - Outside of North America, see the HP web site for locations and telephone numbers: http://www.hp.com/support.
- To order through HP:
  - Call 1-800-538-8787 (North America only).
  - Visit us online at http://www.hp.com/go/storagemedia.

Part numbers for tape cartridges and barcode labels

Table 34 HP tape cartridges and barcode labels

Tape drive type/product	HP part number
Ultrium 460	
Data cartridge	C7972A (400 GB)[1]
Prelabeled data cartridge	C7972AL (400 GB[1]—Europe, Americas only)
Universal cleaning cartridge	C7978A
Barcode label pack (100 data labels, 10 cleaning labels)	Q2002A
Ultrium 960	
Data cartridge, read/write	C7973A (800 GB[1])
Data cartridge, WORM (write once, read many)	C7973W (800 GB[1])
Prelabeled data cartridges, read/write, 20 pack	C7973AL (800 GB[1]—Europe, Americas only)
Prelabeled data cartridges, WORM, 20 pack	C7973WL (800 GB[1]—Europe, Americas only)
Universal cleaning cartridge	C7978A
Barcode label pack, read/write (100 data labels, 10 cleaning labels)	Q2007A
Barcode label pack, WORM (100 data labels, 10 cleaning labels)	Q2008A
Ultrium 1840	
Data cartridge, read/write	C7974A (1.6 TB[1])
Data cartridge, WORM (write once, read many)	C7974W (1.6 TB[1])
Non-custom prelabeled data cartridges, read/write, 20 pack	C7974AN (1.6 TB[1]—Europe, Americas only)
Custom prelabeled data cartridges, read/write, 20 pack	C7974AL (1.6 TB[1]—Europe, Americas only)

Table 34 HP tape cartridges and barcode labels *(continued)*

Tape drive type/product	HP part number
Custom prelabeled data cartridges, WORM, 20 pack	C7974WL (1.6 TB[1]—Europe, Americas only)
Barcode label pack, read/write (100 data labels, 10 cleaning labels)	Q2009A
Barcode label pack, WORM (100 data labels, 10 cleaning labels)	Q2010A
Ultrium 3280	
Data cartridge, read/write	C7975A (3.0 TB[1])
Data cartridge, WORM (write once, read many)	C7975AL (3.0 TB[1], Europe, Americas only)
Non-custom prelabeled data cartridges, read/write, 20 pack	C7975W (3.0 TB[1])
Custom prelabeled data cartridges, read/write, 20 pack	C7975WL (3.0 TB[1], Europe, Americas only)
Custom prelabeled data cartridges, WORM, 20 pack	C7978A
Barcode label pack, read/write (100 data labels, 10 cleaning labels)	Q2011A
Barcode label pack, WORM (100 data labels, 10 cleaning labels)	Q2012A

[1] Capacity values assume a 2:1 compression ratio

D Installing a redundant PDU

PDU components

The library comes with one PDU installed. For a variety of reasons, it may be desirable or necessary to add a second PDU to the library rack. The factors that determine when to add a second PDU are described below.

The main PDU components are:

- High voltage modular PDU, 200–240 VAC, 16 amp, part number 252663-B24 (kit includes two power strips and mounting hardware)
- Main power cord, L6-20P 20 amp, 220 V, twist lock, part number 340653-001
- Power cords (PDU to library), 1/2 meter, part number 142257-B28

Leakage current

The most overriding reason to add a second PDU to the rack is to meet safety requirements for leakage current. Regulations limit the amount of leakage current per power outlet to 3.5 mA. This is the amount of current that may be returned through the ground line to the wall outlet, and therefore is the amount of leakage current allowed per PDU.

The individual power supplies of the library may each contribute a maximum of 0.5 mA. This means no more than seven of the library power supplies may be attached to a single PDU. A fully configured library, with redundant power supplies, would necessitate 10 power supplies. In that configuration, a second PDU is certainly required. Even a 32U-high configuration of the library with redundant power supplies would require a second PDU. Even if redundant power supplies are not currently installed, you should consider adding a second PDU when the library is expanded above 24U in height. With a second PDU installed, upgrading to redundant power supplies in the future is simplified by being able to just slide them into place and connect them to the power strip.

If equipment is added to the library rack from other sources, it is your responsibility to determine the maximum leakage current from all the equipment using the PDU so that the 3.5 mA limit on a single PDU is not exceeded.

Redundancy

Another important reason to add a second PDU to the library rack is to add another layer of power redundancy to the product. As redundant power supplies are added to library modules, the system can be made even more fail-safe by powering individual power supplies, one from each module, with separate AC power circuits. This requires a second PDU.

Every library module level (for example, the base module, card cage expansion module, tape drive expansion module, and so on) can have redundant power supplies added as an option. Each module level, with each power supply powered from different AC circuits, ensures continued library operation should one of the AC power outlets fail. The location of the power strips for the second PDU are installed in a manner such that the power cords of the redundant power supplies of each module level can easily reach the PDU.

Power rating

As was the case with leakage current, if equipment is added to the library rack from other sources, it is your responsibility to make sure the power rating of the PDU and power cords are not exceeded by the load of this additional equipment. The power rating of the PDU is sufficient to power up to seven power supplies in the library that are allowed by the leakage current specification. You must check the power ratings of any additional equipment added to the rack, the power rating of the PDU, and the power rating of the power cords, to make sure all are within specified limits.

Placement of redundant PDU components

The library primary PDU (#1) and two power strips (#1 and #3) are installed at the factory. The redundant PDU (#2) is installed above the primary PDU, also in a 0U side mount position. The top of PDU #1 is approximately 33 cm (13 inches) from the caster boss. The top of PDU #2 is placed approximately 63 cm (25 inches) from the caster boss (see (page 105)).

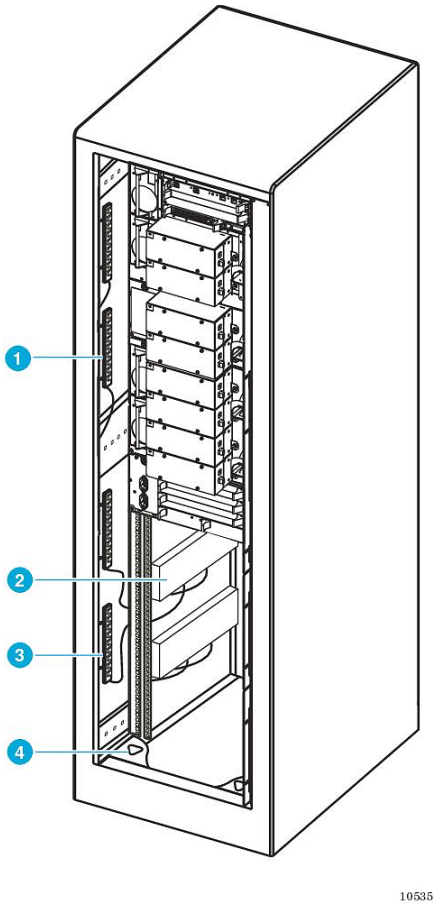
Power strip #2 is placed equidistant between power strips #1 and #3.

Power strip #4 is placed in a position low in the rack so that it does not interfere with the power cords coming from PDU #1 to power strips #1 and #3.

With properly placed power strips in a fully redundant 40U configuration, the top six power supply cords go to power strips #1 and #2. One power cord at each redundant level goes to each power strip.

Similarly, the bottom four power cords in a fully redundant configuration are divided between power strips #3 and #4. By using 0.5-m (15-inch) power cords, the dressing should be minimal.

Figure 59 Redundant PDU and power strip placement



1. Power strip #2
2. Redundant PDU (#2)
3. Power strip #4
4. Caster boss

Installation of redundant PDU components

Refer to the instructions provided with your redundant PDU for installation steps. After installation, dress all cords with cable ties. In addition, use cable ties to lock the power cords coming out of the PDU that go to each power strip.

Glossary

array	(1) A section of vertical or horizontal tape cartridge receptacles inside a library. (2) A molded unit that holds multiple cartridges.
backplane	The storage system electronic printed circuit board into which storage system devices can be plugged.
barcode reader	A component of the robot that is used for tape cartridge identification and position calibration.
base module	The 12U module in every HP Enterprise Modular Library E-Series that contains the robot, tape drives, and card cage for controller cards. For slot numbering purposes, the base module is divided into a base unit (8U) and tape drive expansion module (4U).
card	*Also called* printed wire assembly or printed circuit board.
cartridge	The plastic housing around a cartridge tape. A plastic leader block is attached to the tape for automatic threading when loaded in transport. The spine of the cartridge contains a label listing the volume identification number.
cartridge array	*See* array..
center door	A door on the center-front of a library through which service personnel or operators can access the interior of the library.
Class A digital device	Class A equipment is intended for commercial installation.
Class I laser product	Class 1 lasers are products where the power of the laser beam produced (the accessible emission) is always below the Maximum Permissible Exposure value. Therefore, for Class 1 lasers the output power is below the level at which it is believed eye damage will occur. Exposure to the beam of a Class 1 laser will not result in eye injury. Class 1 lasers may therefore be considered eye safe.
Class II laser product	Class 2 lasers are limited to a maximum output power of 1 mW. A person receiving an eye exposure from a Class 2 laser, either accidentally or as a result of someone else's deliberate action (misuse) will be protected from injury by their natural blink reflex. This is a natural involuntary response which causes the individual to blink and avert their head thereby terminating the eye exposure.
cleaning cartridge	A tape cartridge that contains special material to clean the tape path in a transport or tape drive. LTO cleaning cartridges labels have CLN prefixes.
CLI	Command Line Interface
CompactPCI (cPCI)	Industry standard bus used for card-to-card bus expansion.
containment box	A box in the HP Enterprise Modular Library robot that holds the lift-flex cable. The cable retracts into the box as the table is raised.
data cartridge	A term used to distinguish a cartridge onto which a tape drive may write data from a cartridge used for cleaning purposes.
drive	The device that the library uses to record data onto tapes. *Also called* tape drive.
drive cleaning	A library feature that uses a cleaning cartridge to clean a tape drive.
drive module	The entire assembly that houses the tape drive, including the metal housing and connectors.
ESD	Electrostatic discharge. The release of static electricity from one conductor to another.
Ethernet	A local-area, packet-switched network technology. Originally designed for coaxial cable, it is now found running over shielded, twisted-pair cable. Ethernet is a 10- or 100-megabytes-per-second LAN.
event	A significant library occurrence (such as tape drive errors, online/offline transition, tape drive cleanings, and other information) that is listed in an automated log.
export	The action in which the library places a tape cartridge into the load port so that the operator can remove the cartridge from the library.
Fibre Channel	A bidirectional, full-duplex, point-to-point, serial data channel structured for high performance capacity. The Fibre Channel is an interconnection of multiple communication ports, called N_Ports. These N_Ports are interconnected by a switching network, called a fabric, to a point-to-point link,

	or an arbitrated loop. Fibre Channel is a generalized transport mechanism with no protocol of its own. A Fibre Channel does not have a native input/output command set, but can transport existing Upper Level Protocols (ULP) such as SCSI. Fibre Channel operates at speeds of 200 MB per second. Fibre Channel operates over distances of up to 100 m over copper media or up to 10 km over optical links.
flash memory	Firmware memory for the current and previous version of library firmware.
get	An activity in which a robot obtains a tape cartridge from a slot or tape drive.
GUI	Graphical user interface. Software that enables the user to control the library environment through visual screens.
HBA	Host bus adapter. A circuit board residing in the host system that handles requests to and from the host system and the library.
host	One or more computers that generate and communicate data to the library.
hot-swappable	The capability that enables a component to be replaced while power to the component is maintained. This feature enables hardware maintenance actions and hardware upgrades to proceed without disrupting subsystem availability.
HP (unit of measure)	Horizontal pitch. A measurement of the width of a chassis. Library circuit card assemblies sitting horizontally in card cages are measured vertically in these units where one HP is 5.08 mm (0.2 inches).
HP Enterprise Modular Library E-Series	An automated tape library composed of a: • Base module • Tape drive expansion module (optional) • Card cage expansion module (optional)
import	The process of placing a tape cartridge into the load port so that the robot can insert it into a storage slot.
initialization	A procedure that activates a machine reset, initiates wake-up diagnostics (from EPROMs) and loads functional code.
interlock switch	A switch that disconnects power to library mechanisms, excluding tape drives, when the center door is opened.
inventory	The process of reading and storing in memory the barcode identification and locations of all tape cartridges in the library.
IPv4	IPv4 is an Internet Protocol that contains addressing information and some control information that enables data to be routed in a network. IPv4 has an IP address size of 32 bits and is written as four numbers separated by periods. An IPv4 address contains numerals only (0–255). A sample IPv4 IP address looks like: 127.0.0.1.
IPv6	IPv6 is an Internet Protocol that contains addressing information and some control information that enables data to be routed in a network. IPv6 has an IP address size of 128 bits and is in hexadecimal format (base 16). An IPv6 address can contain numerals (0-9) and some letters (a-f). A sample IPv6 address looks like: 3ffe:ffff:100:f101:210:a4ff:fee3:9566.
lift drive assembly	A component of the robot that moves the table assembly vertically among the library modules.
lift drive pulley	A component of the lift drive assembly used to move the table assembly vertically along the lift pole to slots and tape drives.
lift pole	The device that guides the vertical movement of the table assembly.
lift reduction gear	The component of the lift drive assembly that controls the lift drive pulley.
lift suspension cables	Four cables used to lift and lower the table assembly among the library modules.
lift-flex cable	The cable that carries control and power signals to the table assembly. This cable automatically adjusts to the position of the table assembly in the library.
load port	A device in the library that enables an operator to insert or remove tape cartridges during library operations.
logical library	A virtual representation of a physical library. *Also called* virtual library partition.

magazine	A removable array that holds tape cartridges and is placed into the load port.
PCI	Peripheral component interconnect. The PCI bus typically runs at speeds of 33 MHz or 66 MHz and is usually 32 bits wide. This means that it passes 32 bits of data simultaneously as if down 32 separate wires. Some of the most recent computers include wider 64-bit PCI buses, and already certain very high-end video capture cards offer improved performance if connected to a 64-bit PCI bus.
picker	The portion of the picker assembly that grasps and holds a tape cartridge.
picker assembly	A part of the library robot whose function is to grasp tape cartridges and move them between slots and tape drives. A barcode scanner on the hand assembly reads tape cartridge volume labels.
put	An activity in which a robot places a tape cartridge into a slot or tape drive.
PWA	Printed wiring assembly.
reach mechanism	A component of the robot that moves the gripper to get or put a tape cartridge at a designated location.
robot	An electro-mechanical device that transports tape cartridges to and from locations in the library.
robotics unit	The unit that includes the robotics components and that controls the movement of the robot between slots, tape drives, and load ports.
RS-232C	Short for Recommended Standard-232C, a standard interface approved by the Electronic Industries Association (EIA) for connecting serial devices. This standard is for asynchronous transfer between computer equipment and accessories. Data is transmitted bit by bit in a serial fashion. The RS-232 standard defines the function and use of all 25 pins of a DB-25 type connector.
slot	The location in the library in which a tape cartridge is stored.
slot database	The tape cartridge and slot records collected by the library inventory.
suspension cable	One of four cables used to raise and lower the table.
table assembly	A component of the robotics unit that carries the picker assembly vertically among the library modules.
tape cartridge	A container holding magnetic tape that can be processed without separating the tape from the container. The library uses data and cleaning cartridges. These cartridges are not interchangeable.
tape drive	An electromechanical device that moves magnetic tape and includes mechanisms for writing and reading data to and from the tape.
tape drive assembly	An interface to control/monitor tape drive operation.
U	A measure of chassis height. 1U in rack measurement is 44.45 mm (1.75 inches). Circuit card assemblies using the cPCI standard use the Eurocard range of circuit card sizes, where 3U cards are 100 x 160 mm (3.94 x 6.3 inches) and 6U cards are 230 x 160 mm (9.187 x 6.3 inches). The Interface Manager card is considered 4U wide with dimensions of 161.9 x 157.3 mm (6.4 x 6.2 inches).
World Wide Name (WWN)	A 64-bit integer that identifies a Fibre Channel port.
wrist	A component of the hand assembly that rotates the hand horizontally.

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